FOOD MANUFACTURE

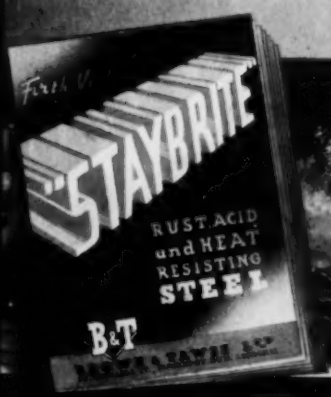
Incorporating Food Industries

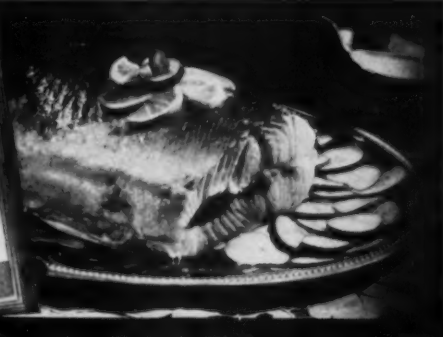
PUBLISHERS: LEONARD HILL LIMITED, 17, STRATFORD PLACE, LONDON, W.1 JANUARY 5, 1940

B&T

Firth-Vickers "STAYBRITE" Stainless Steel

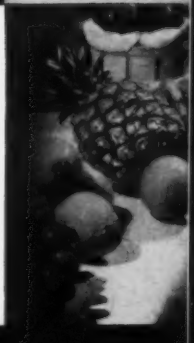
in SHEETS · RODS BARS · SUNDRIES





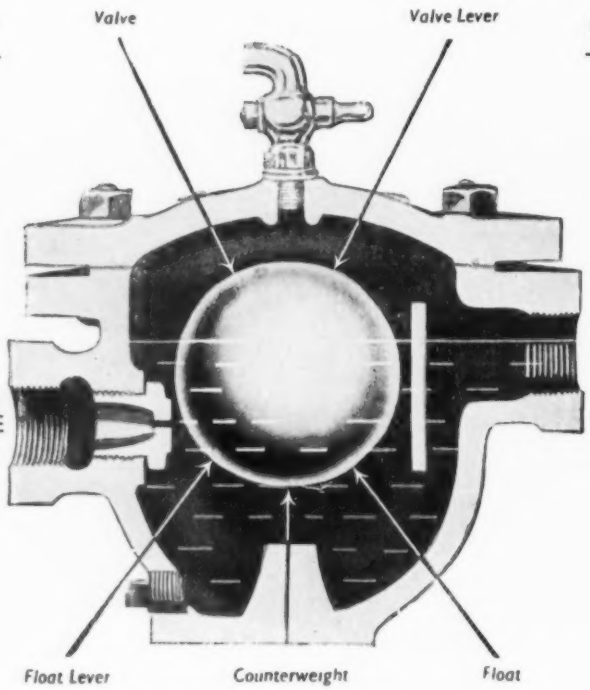
We hold large stocks of Firth Vickers Stainless and "Staybrite" Steels. These steels are of different compositions to meet varying conditions, and are supplied in all forms necessary for the construction of plant, equipment and machinery.

● *Write for a copy of the "Staybrite" Steel Catalogue.*



BROWN & TAWSE LTD

"SIMPLICITY" STEAM TRAPS



HIGHEST EFFICIENCY
SIMPLE ACTION
CONTINUOUS DISCHARGE

LIGHT IN WEIGHT
HIGH CAPACITY
"STAYBRITE" STEEL BALL

THE KEY ENGINEERING CO., LTD.
4 QUEEN VICTORIA ST., LONDON, E.C.4 and TRAFFORD PARK, MANCHESTER
Telephone: CITY 2235 Telephone: TRAFFORD PARK 1903

The Recognised Specialists
1863 for all TINS for 1939
Preserved Provisions

- TINS To stand the Highest Pressure and Vacuum during Processing.
- TINS To retain the Delicate Flavour of your Products.
- TINS To keep the Natural Colour of your Foods.

Modern Double-Seaming Machinery,
Chucks, etc., at Lowest Prices, installed in all parts of the country.

Telephone No.: BERMONDSEY 1753 (5 Lines).

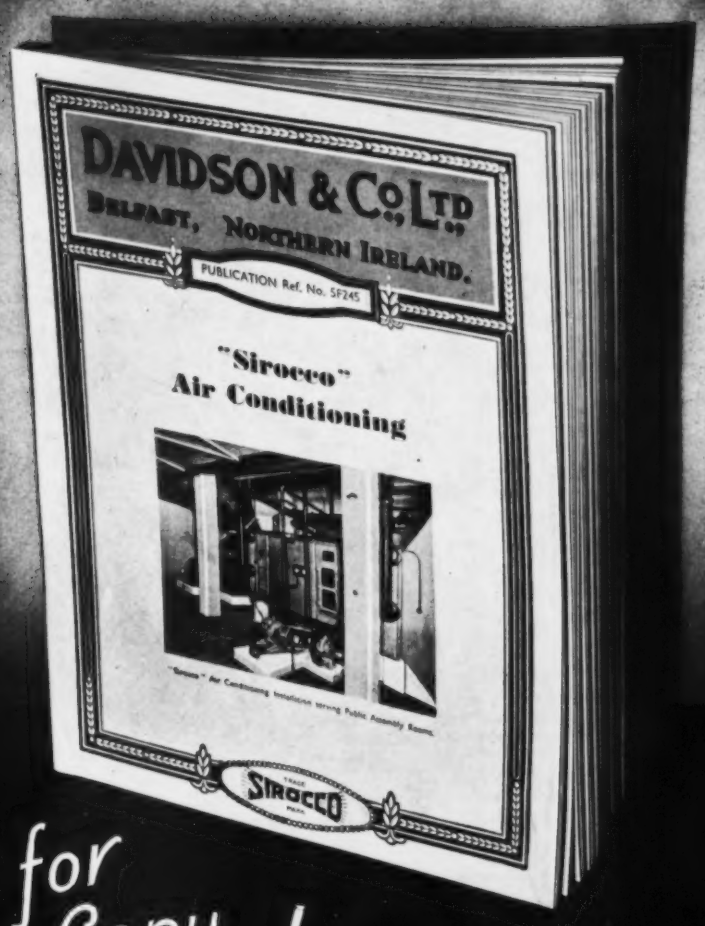
JOHN FEAVER LTD.

120, TOWER BRIDGE ROAD, LONDON, S.E. 1

Telegraphic Address: "TINPLATE, PHONE, LONDON."

Index to Advertisers, see pages iv, vi, viii & x

"Just Published"



Send for Your Copy to-day!

DAVIDSON & CO. LTD., SIROCCO ENGINEERING WORKS, BELFAST

LONDON · MANCHESTER NEWCASTLE · BIRMINGHAM · CARDIFF · GLASGOW · DUBLIN · BRISTOL

• AIR CONDITIONING ENGINEERS •

N3/762

Index to ADVERTISERS

	PAGE
Aerograph Co., Ltd.	xxx
Albro Fillers & Engineering Co., Ltd.	xiv
Alfa-Laval Co., Ltd.	Dec.
Alite Patent Machine Co., Ltd., The	xlix
Allen, Stafford, & Sons, Ltd.	xiv
Aluminium Plant and Vessel Co., Ltd.	Nov.
Angel, H. Reeve, & Co., Ltd.	xlv
Ashworth & Parker, Ltd.	Nov.
Automatic Coil Winder & Elect. Equipment Co., Ltd.	xli
Automatic Weighing and Packing Machine Co.	Dec.
Baker Perkins, Ltd.	Dec.
Baldwins, Ltd.	Dec.
Barron, W. S., & Son, Ltd.	xli
Bennett & Jenner, Ltd.	Nov.
Beth Label and Wrapper Machines, Ltd., The	Dec.
Birmingham Electric Furnaces, Ltd.	xliii
Biro, G. J.	Nov. 10
"Blandola" Co., Ltd., The	Dec.
Boehm, Fredk., Ltd.	Dec.
Booth, J., & Son, Ltd.	Dec.
Bouckley, F., Ltd.	Nov. 10
Braby, Fredk.	xxvi
Brierley, Wm., Collier & Hartley, Ltd.	xii
Briggs, S., & Co., Ltd.	xxix
Britannia Folding Box Co., Ltd.	I
British Aluminium Co., Ltd., The	Dec.
British Couverture Co., Ltd.	I
British Hygienic Containers, Ltd.	Dec.
British Steam Specialties, Ltd.	xxxix
British Thomson-Houston Co., Ltd., The	Nov.
British Vegetable Parchment Mills, Ltd., The	Dec.
British Waxed Wrappings, Ltd.	Dec. 15
Broadbent, T., & Sons, Ltd.	Dec.
Brockhouse Heater Co., Ltd.	Dec.
Brown & Tawse, Ltd.	Front Cover
Bryan, W., Ltd.	Dec. 22
Buffoline Noiseless Gear Co., Ltd., The	Dec.
Burdick, C. L., Mfg. Co., Ltd.	xliii
Burleigh, Ltd.	Dec. 22
Bush, W. J., & Co., Ltd.	Dec.
Butterfield, W. P., Ltd.	Dec.
Butterley Co., Ltd., The	Dec.
Callow Bros., Ltd.	xlviii
Cameron Can Machinery Co.	xxvii
Canning Town Glass Works, Ltd.	xxxiii
Chater, J., & Sons, Ltd.	xlviii
Constructors, Limited	xxxv
Cowles, E., Ltd.	Nov.
Crofts (Engineers), Ltd.	xliii

FOR BUYERS' GUIDE, SEE WEEKLY EDITION

(Continued on page vi

SMITH'S PATENT UNIVERSAL SOLDER BATH

SUITABLE FOR TINS AND CANS OF ANY SHAPE, PROVIDED THEY ARE FITTED WITH RECESSED ENDS

MANY REASONS WHY YOU SHOULD CONSIDER THIS MACHINE—NOW

Marks the latest method of soldering cans irregular in shape.
Operation quick, clean, efficient.
Only a second to change-over.
No wasted solder.
Bad or rough finish eliminated.
Reliable for use on all shaped cans whether empty or filled.
Of importance to all tin box users and makers.
Supplied for gas or electric heating.
Lacquered and printed cans also accommodated, provided sufficient margin is available.
Total immersion of seam prevents leakers and strengthens the end.

Don't delay—try this machine on approval.

BEAUFORT RD.
BIRKENHEAD
Telephone:
BIRKENHEAD 1527
(2 lines)

London Office:
36 VICTORIA ST.
S.W.1
Telephone:
ABBEY 2640

Moon Brothers LIMITED

Distinctive Moulded Closures, manufactured in opaque and translucent colours from all types of powder and injection mouldings, can be supplied from stock moulds or to suit customers' own requirements.

THE PERFECT PAIR · BOTTLE & CLOSURE

by

U.G.B

UGB BOTTLES & CLOSURES

UNITED GLASS BOTTLE MANUFACTURERS LTD

The Largest Manufacturers of Glass Bottles in Europe

LEICESTER STREET LONDON WC2

Telephone
Gerrard 8611 (10 lines)

Telegrams
"Unglaboman, Lesquare, London"

P.P.

Index to ADVERTISERS

	PAGE
Danks of Netherton, Ltd.	Dec.
Davidson & Co., Ltd.	iii
Dawson Bros., Ltd.	Dec.
Dewey & Almy, Ltd.	Dec.
Drayton Regulator & Instrument Co., Ltd., The	Back Cover
Duché, T. M., & Sons (U.K.), Ltd.	xviii
Dunford & Elliott (Sheffield), Ltd.	Dec.
Edison, Thos. A., Ltd.	Dec. 15
Edme, Ltd.	Dec.
Egg Packing Materials, Ltd.	Dec.
Elliott Bros. (London), Ltd.	xliv
Ellison Insulations, Ltd.	xlix
Ellison, Ltd., Geo.	ix
Enamelled Metal Products Corpn. (1933), Ltd.	Dec.
Engel, Henri	Oct.
English Corrugating Paper Co., Ltd.	Dec. 15
English Grains Co., Ltd., The	xlvii
Ericsson, C. O., Engineering Works, Ltd., The	Oct.
Evans, Adlard & Co., Ltd.	xli
Evans, J., & Sons (Wolverhampton), Ltd.	xliii
Evans Sons Lescher & Webb, Ltd.	Oct.
Evans, Wm., & Co. (Hereford & Devon), Ltd.	xxviii
Evershed & Vignoles, Ltd.	x
Farrow & Jackson, Ltd.	Oct. 27
Feaver, J., Ltd.	Inside Front Cover
Federated Sales, Ltd.	Dec.
Field, C. W., Ltd.	I
Filling Machines, Ltd.	Dec.
First Aid Supply Co.	Nov.
Firth-Vickers Stainless Steels, Ltd.	Oct.
Flach, Joseph, & Sons, Ltd.	xlvii
Flexotube (Liverpool), Ltd.	xlvii
Fraser & Chalmers Engineering Works	Dec.
Fraser, John, & Son, Ltd.	xlii
Frick Co.	xxxix
Fuller, W, M., Junr., & Co.	Oct.
Gallenkamp, A., & Co., Ltd.	Dec.
Gardner, Wm., & Sons (Gloucester), Ltd.	xxxvi
G. C. Engineering Co., Ltd.	Nov.
General Electric Co., Ltd.	xxxii
Gloy and Empire Adhesives, Ltd.	xxiv
Glycerine, Ltd.	Oct.
Glynn & Co., Ltd.	Dec. 15
Graham, Wm., & Co.	xlvii
Greening, N., & Sons, Ltd.	Dec.
Greenwood & Batley, Ltd.	Dec. 8
G.V.D. Illuminators, Ltd.	Dec.
Hall, J. & E., Ltd.	xl
Hedley, Thomas, & Co., Ltd.	xxxii
Herbs and Drugs, Ltd.	Dec. 22
Holden, Arthur, & Sons, Ltd.	vii
Holden & Brooke, Ltd.	xxxi
Honeywill & Stein, Ltd.	Oct.
Hope's Heating & Lighting, Ltd.	xxi
Horner, L. A., & Sons	Dec. 22
Hunter Machines Co., Ltd., The	Dec.
Hydran Products, Ltd.	Oct.

FOR BUYERS' GUIDE, SEE WEEKLY EDITION

[Continued on page viii

Outstanding performance - Negligible upkeep!

NIAGARA
air draught
STOKER

2 CORNISH BOILERS EQUIPPED FOR C. SHIPPAM, LIMITED

SMOKELESS COMBUSTION Co. Ltd.
CANES INN HOUSE, ALDWYCH, LONDON, W.C.2.
Telephone:- HOLborn 5409

defence measures

Anti-acid, non-poisonous gold coating, preserves the rich fresh colour and flavour of fruits.

SUPER ZINNATINE

Thesulphur resisting ZINNATINE, prevents those blackening stains in vegetable packs.

SULFATINE

Preserves the fresh sea flavour of fish, and provides a lacquer film that will not fracture in the process of deep drawing.

ZINNATINE MARINA

Zinnatine Lacquers form the ideal protection squad for service in every can. For fish . . . for fruit . . . or vegetables . . .—there's a specially produced Zinnatine Lacquer for each . . . Lacquers that give a film proof against all chemical action, preserve the full natural flavour and colour, and ensure that the contents turn out as perfect as they were canned.

Full particulars sent on request.

Established a Century

ARTHUR HOLDEN & SONS LTD.

BIRMINGHAM

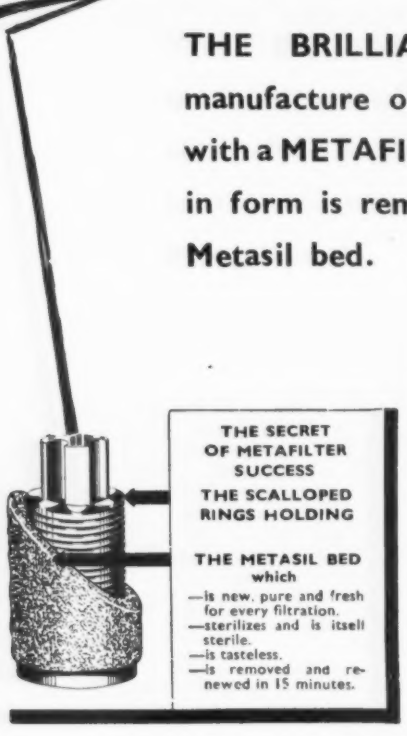
Index to ADVERTISERS

	PAGE
Improved Emulsification Process Co., Ltd.	Oct.
Jackson, J. G., & Crockatt, Ltd.	Dec.
James, Frank A.	xlv
Jarman & Cowley	Dec. 15
Johnson, A., & Co., Ltd.	xviii
Johnson, S. H., & Co., Ltd.	xxviii
Kellie, Robert, & Son, Ltd.	xxxvii
Kent, Geo., Ltd.	Oct.
Kestner Evaporator and Engineering Co., Ltd.	xvi
Key Engineering Co., Ltd., The	Inside Front Cover
Kirtley, G. Henry, & Co.	Dec. 29
Kniveton, F. M.	Dec. 15
Kork-N-Seal	Nov.
Kustner Bros. & Co., Ltd.	Dec.
Laing, J., & Son, Ltd.	Dec.
Lambert, L., & Co.	xlviii
Lax & Shaw, Ltd.	xxxviii
Leigh, W. & J., Ltd.	Dec. 15
London Oil Corporation, Ltd.	xlviii
London Shafting & Pulley Co., Ltd.	xlii
MacAndrews and Forbes, Ltd.	xxv
Macnaughton & Watson, Ltd.	xlix
Magnus, Mabee, & Reynard, Inc.	Dec. 15
Marconi-Ekco Instruments, Ltd.	xxi
Marler, E. T.	Dec. 22
Mason, A. H., & Co., Ltd.	Dec. 22
Mayer Senior, H., Ltd.	xlv
Medway Corrugated Paper Co., Ltd.	xix
Mellor, Bromley & Co., Ltd.	xl
Metafiltration Co., Ltd.	viii
Metal Box Co., Ltd., The	Nov.
Metropolitan Vickers Electrical Co., Ltd.	Dec.
Miracle Mills, Ltd.	Dec.
Mitchell, L. A., Ltd.	xlii
Moon Bros., Ltd.	iv
Morton Machine Co., The	Nov.
Morton, Robert, & Co., Ltd.	xxxiii
Muntona, Ltd.	xlii
Murphy & Son, Ltd.	I
Musgrave & Co., Ltd.	xxx
National Adhesives, Ltd.	Nov.
National Glass Works (York), Ltd.	xxv
Negretti & Zambra	xxii
Nichols, J., & Son, Ltd.	Dec.
Ormerod Engineers, Ltd.	Dec.
Parkes, Zach., Ltd.	xlviii
Pearlite Box Co., Ltd.	xvi
Perry & Hope, Ltd.	Nov.
Phillips, R., & Son, Ltd.	Dec. 22
Pickfords, Ltd.	xlv
Pointing, L. J., & Son	Dec. 22
Polak & Schwarz (England), Ltd.	xxiii
Poppe Rubber & Tyre Co., The	Oct.
Porteus, Geo., & Sons (Leeds), Ltd.	Dec.
Powers-Samas Accounting Machines, Ltd.	Dec. 15
Powley, R., & Sons, Ltd.	Nov.

FOR BUYERS' GUIDE, SEE WEEKLY EDITION

[*Continued on page x*

This is METAFILTRATION


THE SECRET OF METAFILTER SUCCESS
THE SCALLOPED RINGS HOLDING
THE METASIL BED which
—is new, pure and fresh for every filtration.
—sterilizes and is itself sterile.
—is tasteless.
—is removed and renewed in 15 minutes.

THE BRILLIANT, STERILE FILTRATES necessary in the manufacture of food products are produced simply and quickly with a METAFILTER. BRILLIANT because *all* matter even colloidal in form is removed. STERILE because no bacteria can pass the Metasil bed.

THE HIGHEST MEDICAL TESTIMONY BEARS WITNESS TO THIS

Whether you wish to filter WATER, EXTRACTS, SYRUPS, OILS, the METAFILTER will ensure a perfect filtrate. No pulp, no flimsy bags. METAFILTERS can operate at pressures exceeding 100 lbs./sq. in.

ECONOMICAL • EFFICIENT • COMPACT

CERTAINTY OF SERVICE & SUPPLIES **METAFILTRATION**

Phone: HOUnslow 1121

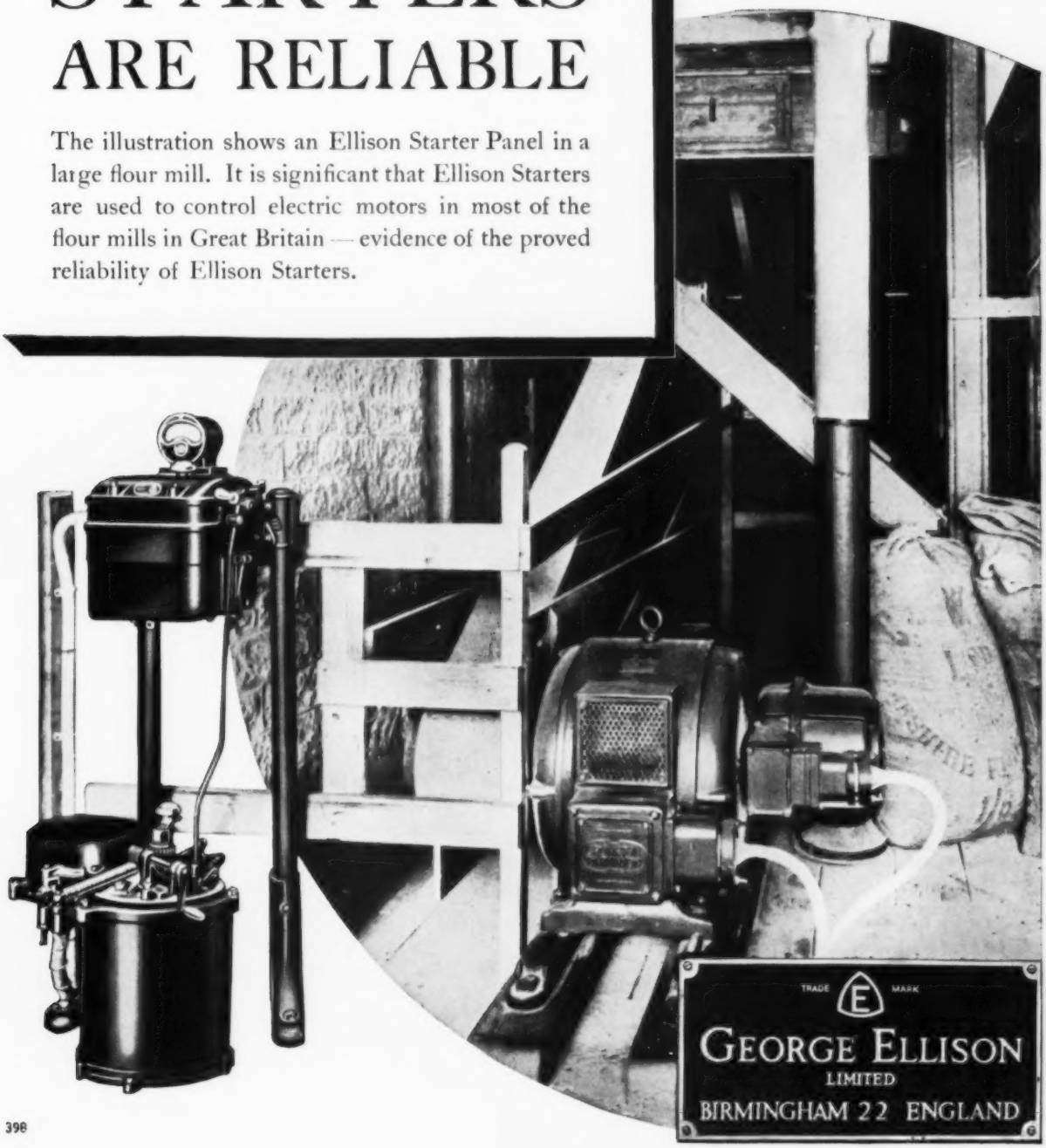
THE METAFILTRATION CO. LTD., BELGRAVE WORKS, HOUNSLOW, MIDDX.

ELLISON

Electric Motor

STARTERS ARE RELIABLE

The illustration shows an Ellison Starter Panel in a large flour mill. It is significant that Ellison Starters are used to control electric motors in most of the flour mills in Great Britain — evidence of the proved reliability of Ellison Starters.



TRADE MARK

GEORGE ELLISON
LIMITED
BIRMINGHAM 22 ENGLAND

398

Index to ADVERTISERS

	PAGE
Premier Colloid Mills, Ltd.	Dec.
Premier Filterpress Co., Ltd.	Dec.
Preston & Thomas, Ltd.	Oct.
Prideaux's, Ltd.	Nov.
Purdy Patent Machinery Co., Ltd.	Dec.
P.X., Ltd	Dec. 22
Randall, J. H., & Son, Ltd.	xxxiv
Ransomes, Sims & Jefferies, Ltd.	Dec.
Reavell & Co., Ltd.	xlviii
Riddell, Wm., Cousland, & Co., Ltd.	xlvi
Roberts Patent Filling Machine Co., Ltd.	xxvi
Rose Containers, Ltd.	xli
Rotoplunge Pump Co., Ltd.	Dec.
Rownson, Drew & Clydesdale, Ltd.	Dec.
Rubeck, H.	xlvi
Rubery, Owen & Co., Ltd.	Dec.
Sankey & Son, J. H., Ltd.	xxxi
Salvarelli Agencies, Ltd.	Dec. 15
Samuelson, P., & Co.	Dec. 15
Saunders Valve Co., Ltd.	xlvi
Scott, Geo., & Son (London), Ltd.	Oct.
Scottish Flavour & Colour Co., Ltd.	Oct.
Seyfried, John F., & Sons, Ltd.	xlv
Sharpe's Engineers	Dec.
Short & Mason, Ltd.	xiii
Simon, R., & Sons, Ltd.	xlvi
SMALL ADVERTISEMENTS	xlvii-l
Smokeless Combustion Co., Ltd.	vi
Soya Foods, Ltd.	I
Spencer-Hopwood, Ltd.	xlv
Spiral Tube & Components Co., Ltd.	Dec. 22
Spirax Manufacturing Co., Ltd.	Inside Back Cover
Standard & Pochin Bros., Ltd., The	xliv
Stanelco Products	xi
Stephens, Henry C., Ltd.	Oct.
Sternol, Ltd.	Dec.
Stevenson & Howell, Ltd.	xxiv
Sturge, J. & E., Ltd.	Dec. 15
Sturtevant Engineering Co., Ltd.	xxxviii
Sunvic Controls, Ltd.	Dec.
Talbot-Stead Tube Co., Ltd.	Sept.
Thomas & Bishop, Ltd.	Dec.
Thompson, John (Dudley), Ltd.	xv
Tintometer, Ltd.	Sept.
Tragasol Products, Ltd.	Dec. 22
United Glass Bottle Co., Ltd.	v
Universal Oil Co., Ltd., The	xxii
Visco Engineering Co., Ltd.	Nov.
Walworth, Ltd.	xvii
Whiffen & Sons, Ltd.	xlviii
Whitmee Engineering Co., The	Dec.
Whittaker, Arthur	Dec. 22
Williams (Hounslow), Ltd.	Dec.
Worthington-Simpson, Ltd.	Dec.

FOR BUYERS' GUIDE, SEE WEEKLY EDITION

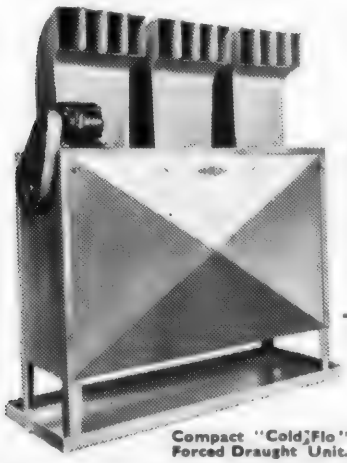
FOOD FOR THOUGHT

Your electrical breakdown is sure to occur at the most awkward moment. It can be prevented by systematic testing with a "Megger" Insulation & Continuity Tester. Send for List FM. 454.

WP.5-8

EVERSHED & VIGNOLES LTD., CHISWICK, LONDON, W.4

TELEPHONE: CHISWICK 1370 ★ TELEGRAMS: "MEGGER," CHISK, LONDON



Compact "Cold Flo" Forced Draught Unit.

Stanelco REFRIGERATION EQUIPMENT

– solves todays problems

Cooling Equipment for Confectionery Works.

TODAY, more than ever before, you will need efficient cooling and refrigeration plant which can be operated with minimum cost and labour, and which is backed by good service.

Each and every refrigeration and cooling project requires individual study to obtain the most efficient planning. Our wide range of equipment permits us to fulfil that planning requirement.

If you will write or telephone today, an experienced engineer will gladly call, examine your problems and submit a comprehensive report.

Quick-Freeze Display and Storage Cabinet.

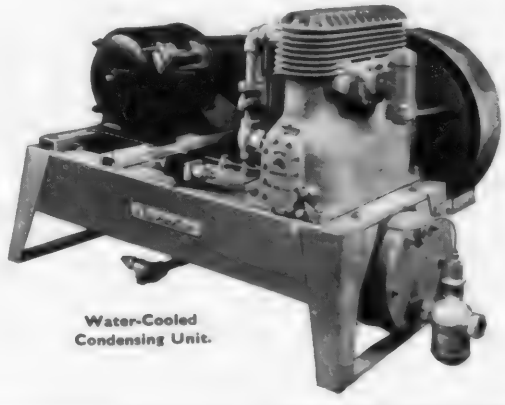
Stanelco Products

PROPRIETORS: STANDARD TELEPHONES AND CABLES LIMITED

FERNDOWN, NORTHWOOD HILLS, NORTHWOOD, MIDDLESEX

Telephone - - - PINNER 4885

Panelled Cold Room.



Water-Cooled Condensing Unit.

REFRIGERATION
FOR FOOD MANUFACTURE

J. & E. Hall Ltd. manufacture compressors and auxiliary equipment for the control of temperature in food manufacturing processes, for cold storage and for air conditioning. For whatever purpose Refrigeration may be required, plant by J. & E. Hall will reach and maintain for exceptionally long periods the highest efficiencies commercially attainable.

Although we are undertaking work for various Government Departments, we are still, and hope to continue to be busily engaged in the manufacture of Refrigerating Plant for commercial users.

If emergency conditions demand refrigerating equipment, the alteration or extension of existing plant, we are at your service for quotations, advice or consultation.

★ **J & E. HALL** ★

LIMITED

REFRIGERATING ENGINEERS

DARTFORD · KENT

LONDON OFFICE: 10 ST. SWITHIN'S LANE, E.C.4

AUTO-FEED ORANGE CHIPPER

PATENT Nos
246069
315167

LATEST MACHINERY

FOR

FOOD PROCESSING
FRUIT PRESERVING
CONFECTIONERY
MANUFACTURE, ETC.

consult

BCH

Wm. BRIERLEY, COLLIER & HARTLEY, Ltd.

BORO WORKS, ROCHDALE

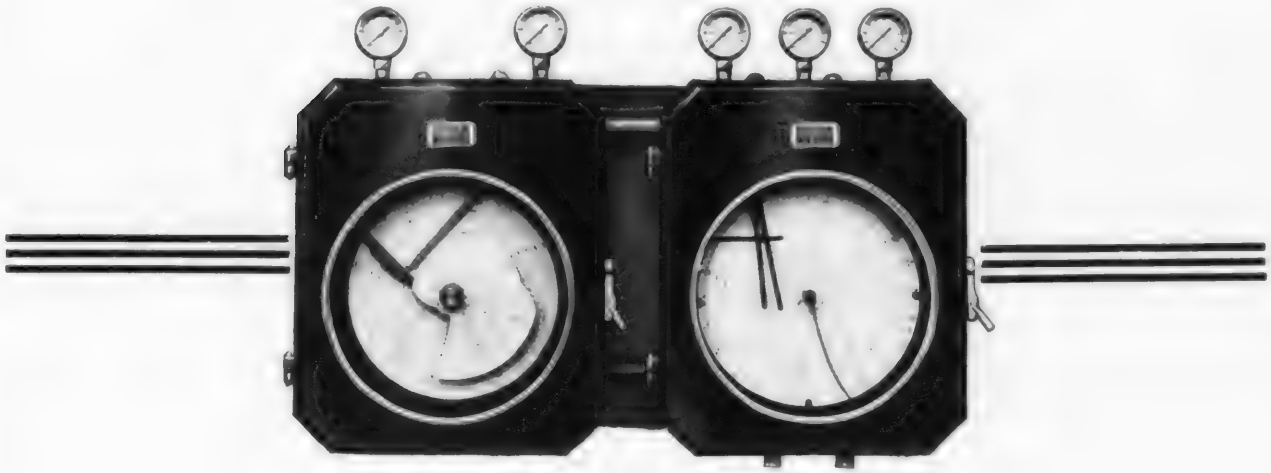
LONDON OFFICE:
SENTINEL HOUSE, SOUTHAMPTON ROW, W.C.1

Established 1835

LARGEST JAM AND CONFECTIONERS' MACHINISTS IN THE TRADE

Time Temperature Pressure

controlled by a CAM!



No. 42RW223 S. & M. Fulscope Time Schedule Temperature Controller

The S. & M. System of Time, Temperature, and Pressure Control with the Short & Mason Time Schedule Controller assures uniformly high quality of canned and glass-packed meat and similar products accurately, dependably and with the minimum of expense.

This system controls the cooking process throughout the entire schedule. It assures uniform processing, prevents glass breakage and bulging of container tops and cans. It saves processing costs by eliminating waste and spoiled products.

Manual control, no matter how efficient, does not prevent variations in temperature and pressure that the S. & M. Time Schedule Controller regulates with automatic precision. When retorts are closed and cooking starts, this controller takes complete command. It automatically turns on steam and air to bring temperature and pressure to the required point, maintains them for the necessary time, shuts off steam, turns on cooling system and brings temperature and pressure down to the desired level at the end of the cooking schedule (and even turns off the cooking water).

This system is only one example of the way Short & Mason serve the Canning and associated industries. Let a Short & Mason representative discuss your problems with you, without obligation.

SHORT & MASON LTD.

THE INSTRUMENT HOUSE

ANEROID WORKS, LONDON, E.17

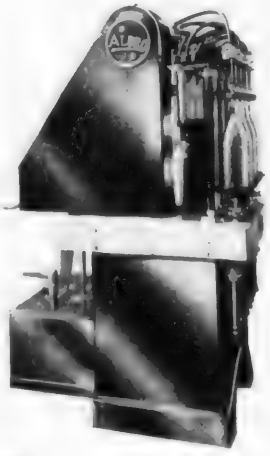
ALBRO FILLERS

Solve your War-time Problems

of **LABOUR SHORTAGE** As skilled labour becomes more scarce, so will your need for Albro Vacuum and Gravity Operated Fillers become greater. These up-to-date machines require only junior unskilled labour for operation—and less skilled workers in maintenance.

ECONOMY Speedy filling need not mean waste. Albro Vacuum and Gravity Operated Fillers cut out wastage and drip. In every way they bring about vital economy. Manufacturers of food powders, for instance, have been able to cut down the size of the tins as filling can be carried out with less air than previously. In the filling of liquids, too, immense savings are assured by the fact that cracked or leaky bottles are rejected.

Albro Fillers are an essential factor in more economical war-time food packing—learn more about them !



Four-Head Vacuum Operated Semi-Automatic Filler with Agitator for Squashes. Output : 100 doz. quarts per hour.

There is a machine to fill YOUR needs in the ALBRO range of 94

ALBRO FILLERS AND ENGINEERING CO., LTD.

Northampton Works, Watson's Road, Wood Green, London, N. 22

Telephone Nos. : Bowes Park 2217 and 2218

STAFFALLENS FLAVOURS

Established 1833

For all types of CONFECTIONERY & FOOD PRODUCTS

Price Lists and Samples sent on request

STAFFORD ALLEN & SONS, LTD.

Manufacturing Chemists

WHARF ROAD, LONDON, N.1

TELEPHONE : CLErkenwell 1000 (7 lines)

JOHN THOMPSON *and the* DAIRY INDUSTRY

We can NOT claim that we have been associated with the Dairy Industry right back to its inception—a period too remote even for recorded history.

But when one-man power transport and one-maid power processing gradually became obsolete, the long experience of John Thompsons in making vessels of every description was immediately available for the needs of the Dairy Industry . . . an experience in fabricating all types of containers plus what is far more important, expert knowledge of all types of interior linings to maintain adequate safeguards against bacteria formation and other contaminations.

Just as the Dairy Industry may represent "a Ministry to the 'interior,'" so are John Thompsons Masters of the 'interior' of all the many forms of Containers they make for Transport, Storage and Processing of Dairy products.

Transport Tank made to the order of Scammel Lorries Ltd.

Stainless Steel 2,000-gal. Storage Tank for a large Dairy Company.

Group of milk-receiving tanks complete with mixing baffles.

John THOMPSON

(DUDLEY) LTD. DUDLEY

ONE OF THE JOHN THOMPSON ENGINEERING GROUP

Pearlite

We Served in 1914 to 1918 – Now Serving

WAX IMPREGNATED

● Moisture-proof, grease-proof, air-tight when sealed.

CONTAINERS

● Can still be obtained for the packaging of

FOODSTUFFS FOR EXPORT

Sole Manufacturers:

PEARLITE BOX CO., LTD., LONDON & MANCHESTER

Head Office: WEST ROAD, LONDON, N.17. Phone No.: TOTT. 5051-2

Concentration of Fruit Juices

A special type of Kestner Patent Multi-Circulation high-vacuum Evaporator has been developed for the concentration of FRUIT JUICES. An outstanding feature of this special evaporator is the provision that has been made for the retention of the volatile fresh fruit flavours—this, combined with short-time contact and low temperatures, makes possible the production of concentrated fruit juices of most exceptional quality.

Write for Leaflet No. 259.

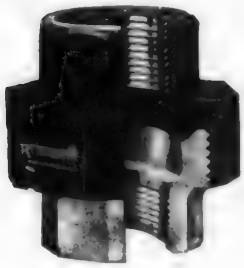
Kestner Evaporator & Engineering Co. Ltd.

Chemical Engineers :: **Glenville Works, Glenville Grove, New Cross, S.E.8**

KEEPING TRADE CHANNELS OPEN

WALWORTH *Means Service*

"KEWANEE" UNION
All Forged



All Forged — Steel and Bronze — Heavy pattern suitable for services up to 250 lbs. working steam pressure.

The Ministry of Supply has fortunately arranged that essential business be carried on by those familiar with the conditions and customs of their respective industries, and through the usual Trade Channels.

If, therefore, you have reliable trade connections, it is best to work with them. If they are not satisfactory, try and make better ones.

WALWORTH

LIMITED

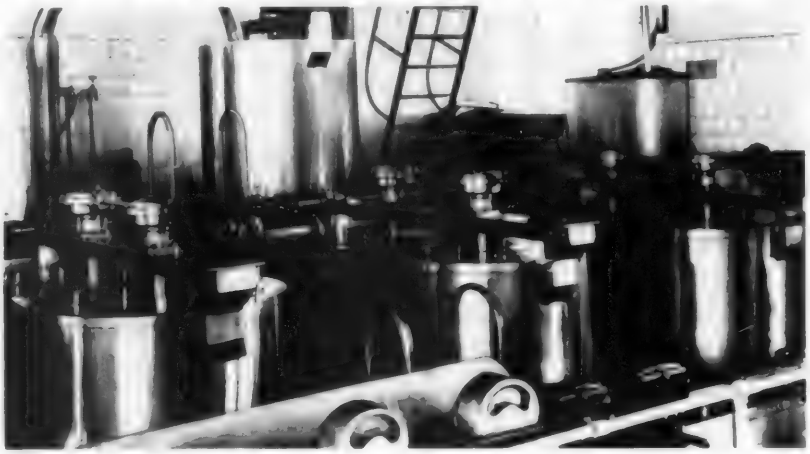
WILL DO THEIR BEST FOR YOU

LONDON:
Walworth Ltd., 90-96 Union Street, Southwark, S.E.1. 'Phone: Waterloo 7081
MANCHESTER:
Walworth Ltd., 26 Bridge St., Deansgate, Manchester, 3. 'Phone: Blackfriars 6773
GLASGOW:
Walworth Ltd., 48 York Street, Glasgow, C.1. 'Phone: Central 6877

TUBES - FITTINGS - VALVES - TOOLS

P.P.

WHERE CLEANLINESS IS VITAL *use*



The illustration shows a battery of emulsifiers for a margarine factory.

Write for particulars of the full range of products, and a free copy of brochure No. F.M.3

A. JOHNSON & CO. (LONDON) LTD.
Africa House, Kingsway, London, W.C. 2
Telephone: Holborn 7337 (5 lines)
Works: Duke's Road, Acton, W.3

SAVESTANE
TRADE MARK

STAINLESS STEEL EQUIPMENT

Savestane Stainless Steel Equipment is being used in ever-increasing quantities in food production.

For cleanliness and easy cleaning there is nothing to equal it. Savestane is solid Stainless Steel all through and vessels made from it are practically everlasting.

GELATINES
OF ALL KINDS

IMPORTERS & DEALERS IN

ALMONDS (Bags & Boxes)	DESICCATED COCOANUT	GLACÉ CHERRIES
WALNUTS	AGAR-AGAR	TARTARIC ACID
BRAZILS (Shelled)	GUM ARABIC	CITRIC ACID
HAZELNUTS	GINGER (Wet & Dry)	PARINA
PEANUTS	COCOA BUTTER	SAGO FLOUR (& Dressed)
	ALBUMEN	MAIZE FLAKES
		SUGAR CANDY, Etc.

FOUNDED IN 1857

T. M. DUCHÉ & SONS [U.K] LTD

Telephone: Mansion House 7681 (3 lines)

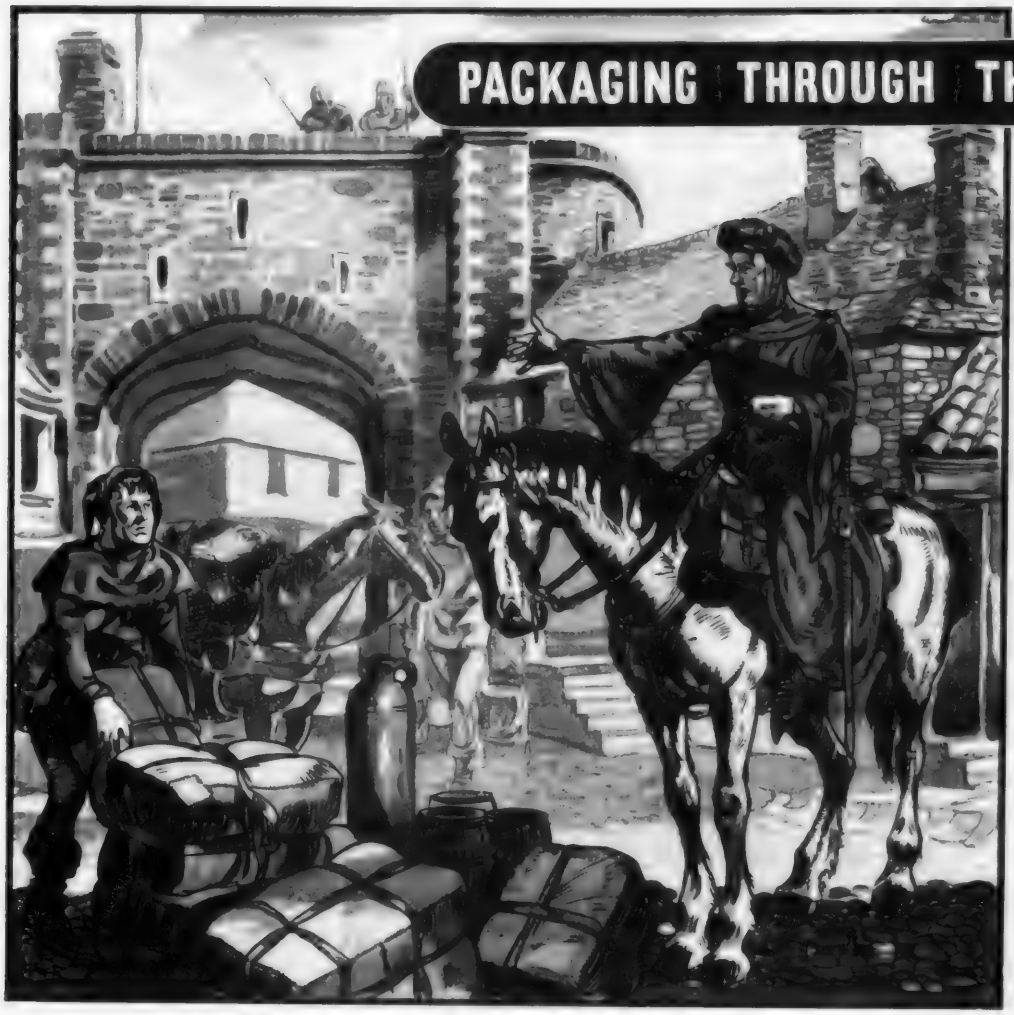
Telegrams: "Duché, London"

ADELAIDE HOUSE, KING WILLIAM ST., LONDON, E.C. 4

BRANCHES AT

MANCHESTER: 5 Marsden St. *Telephone:* Blackfriars 4862 (2 lines) **GLASGOW:** 28 Cadogan St. *Telephone:* Central 6498 (2 lines

PACKAGING THROUGH THE AGES



Bundles wrapped in waterproof oiled materials, and casks containing sugar, were carried by pack horses in the Chaucerian period. Goods packaged in this manner were tied together in large nets to prevent loss and slung across the horses' backs.

..but the MODERN way is the MEDWAY

Where the prestige of the manufacturer is as important as the safety of the goods, the Medway Corrugated Box is the perfect example of scientific packaging.

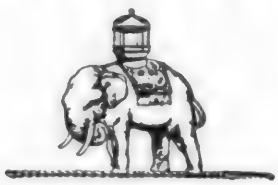
THE MEDWAY CORRUGATED PAPER CO., LTD., MAIDSTONE

London Sales Office :
Blackfriars House, New Bridge Street, E.C.4. Telephone : Central 6022

Provincial Sales Office :
Larkfield, Maidstone, Kent. Telephone : Aylesford 7281

Godbolds

INCREASE YOUR EXPORT TRADE



INDIA AND THE NEAR EAST

offer ever-increasing opportunities.

WRITE TO US—We can put you in touch with Agents and men who know the market. Our Contact Manager spent over twenty years in India and will willingly advise you.

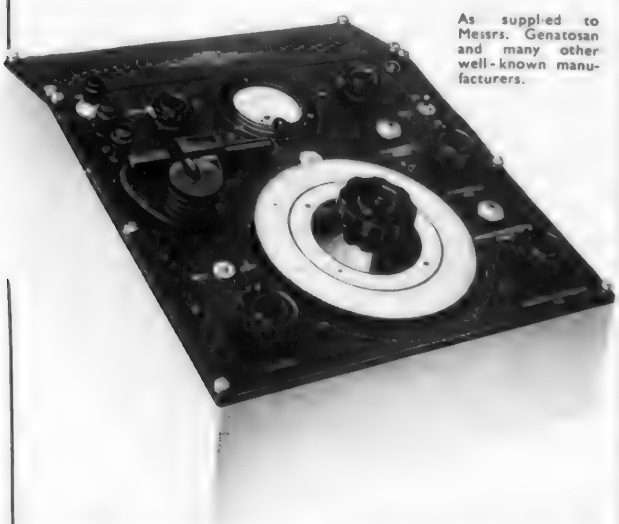
Address: Contact Manager,
INDIAN & EASTERN CHEMIST, 17 Stratford Place, London, W. 1

pH
EQUIPMENT

TYPE TF 452 for BATTERY OPERATION
TYPE TF 452 for MAINS OPERATION
RECORDER TYPE OA 132

★ Scaled directly in pH
★ All electronic in action
★ Standard radio valves
★ Temperature compensation
★ Very robust glass electrodes

Precision products reasonably priced
Ask for folder Ind-A-5
Stocks available



As supplied to Messrs. Genatosan and many other well-known manufacturers.

MARCONI-EKCO INSTRUMENTS LTD

EMERGENCY ADDRESS:—
KNOLL COTTAGE, GILL'S HILL,
RADLETT, HERTS.

Telephone: Radlett 6531 Telegrams: Marconekco, Radlett

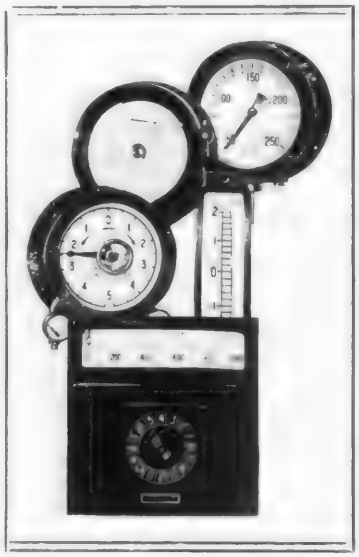
No place for smoke

The GREGYNOG PRESS, near Newtown, Montgomeryshire, printers and publishers of fine books in limited editions, have two 'Economic' high pressure steam boilers fired by HOPE MECHANICAL STOKERS

The clean efficiency of this installation will be seen in the illustration. There is no possibility of smoke nuisance, attendance is reduced to a minimum, and there is a great saving in fuel costs. We can convert your existing plant.

HOPE MECHANICAL STOKERS

Write to:
HOPE'S HEATING & LIGHTING LTD.
HEAD OFFICE: SMETHWICK · BIRMINGHAM



EVERY NEGRETTI & ZAMBRA INSTRUMENT IS SUPPLIED WITH A TWO YEARS' GUARANTEE

Instruments

The popularity of NEGRETTI & ZAMBRA instruments in the Food Industry is due to simplicity of design and robustness, combined with precision and high quality.

Particulars will be sent on request of Dial Thermometers, Recording Thermometers, Automatic Temperature, Pressure and Humidity Controllers, Multipoint Electrical Temperature Indicators and Recorders, or Draught Gauges and Pressure Recorders.

NEGRETTI & ZAMBRA

38 Holborn Viaduct, London

UNIVERSAL

Glycerine

CHEMICALLY PURE B.P.—PALE STRAW

The UNIVERSAL OIL Co. Ltd.

Head Office and Works HULL Telegrams and Cables: UNIVOL, HULL

LONDON Carmel House, 49 Leadenhall Street, E.C.3

GRAPE FRUIT
CHERRY-PLUM
PASSION FRUIT

GOOSEBERRY
RASPBERRY
PEAR - ETC.

ESSENCES

Orchard and fruit farms yield their choicest harvests to Polak and Schwarz, to be transformed by a skill, behind which lies over 50 years of experience, into essences that lose nothing of those exquisite characteristics Nature alone can give.

Polak & Schwarz

(ENGLAND) LTD.

50, GT. CAMBRIDGE RD., ENFIELD
MIDDLESEX

Telephone: Enfield 3244-3245

Essences, Essential Oils, Colours.

"RED BALL" BRAND

STEVENSON & HOWELL LTD.

Specialists to the Food and Beverage Industries for over 50 years.

Home Sales Organisation during Hostilities:
Aldrington Buildings, Occupation Road,
Portland Road, HOVE, Sussex.

Telegraphic Address: "DISTILLER, HOVE." *Telephone:* HOVE 4051.

Export enquiries and correspondence to be addressed to London as hitherto.
Returned Empties should be forwarded to 46, Gravel Lane, London, S.E.1, as usual, not to HOVE.

Gold Medal and Grand Prix 1935 Brussels International Exposition

ADHESIVES

Many Food Manufacturers using Continental Packing Machines, such as Hesser and Jagenberg, have been experiencing difficulty with gum hitherto imported.

- **WE CAN SUPPLY SUITABLE GUM FOR ALL TYPES OF MACHINES AND FOR HAND-PACKING.**

WE GUARANTEE SATISFACTION

We have pleasure in informing food packers that our supplies are normal, and our services as usual.

GLOY & EMPIRE ADHESIVES LTD

ACME WORKS · CLAPTON · LONDON · E.5

Telephone: AMHerst 4746 (4 lines)

Australia:
J. DAVIES & SONS, 20 SOUTH AUDLEY ST.,
ABBOTSFORD, N.9, VICTORIA.

Eire:
PROCEA LTD., ALEXANDRA ROAD,
DUBLIN.

VITAMINS
for foodstuffs

Although during rationing ample supplies of all essential foodstuffs are anticipated, certain articles such as butter will not be available in normal quantities. The public will therefore require to make up the shortage of important food factors like vitamins from other sources, and will buy the commodities in which these essentials are found.

YOUR PRODUCT CAN BE ONE OF THEM AND

"Covitol"

VITAMIN A & D CONCENTRATES

PROVIDE THE MEANS.

"COVITOL" *can be incorporated in practically any manufactured foodstuff without impairing its taste, odour or texture, and the vitamins will remain stable.*

WRITE FOR FURTHER INFORMATION TO THE AGENTS FOR U.K.:

MACANDREWS & FORBES LIMITED

BUSH HOUSE, ALDWYCH, LONDON, W.C. 2

Manufactured by

E. & O. COLLETT & Co., S/A, OSLO, NORWAY

NATIONAL

GLASS WORKS (YORK) LTD.

WORKS

FISHERGATE, YORK

LONDON OFFICE

FIRST AVENUE HOUSE,

HOLBORN, LONDON, W.C.1.

TELEPHONE NUMBERS: HOLBORN 2146 (London) · YORK 3021

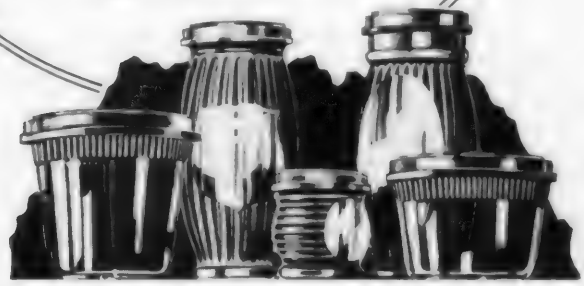
GLASS CONTAINERS OF EVERY DESCRIPTION

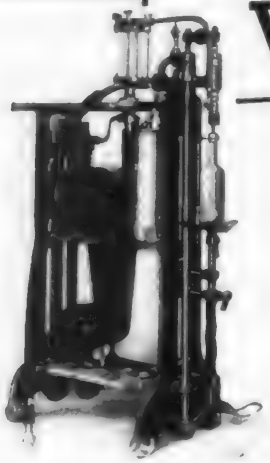
JUST A FEW

"National"

PRODUCTS

- We cater for all Food Manufacturers.
- Prompt Delivery and Service.
- We should be glad to make suggestions for new designs.
- Send us your enquiries.





WE INVITE YOU!

TO CONSIDER THE MERITS OF

ROBERTS PATENT VACUUM BOTTLE FILLERS

SINGLE, DOUBLE, AND TRIPLE HEAD MACHINES

LOW COST AND UPKEEP

HIGH OUTPUT AND EFFICIENCY

SELF-CONTAINED AND COMPLETE PORTABLE UNITS FOR ALL LIQUIDS

CLEAN AND RAPID FILLING. NO WASTE. EASY TO OPERATE

OUR TECHNICAL STAFF IS AT YOUR SERVICE. *We Solicit Your Enquiries*

ROBERTS PATENT FILLING MACHINE CO. LTD.

BOLTON · ENGLAND

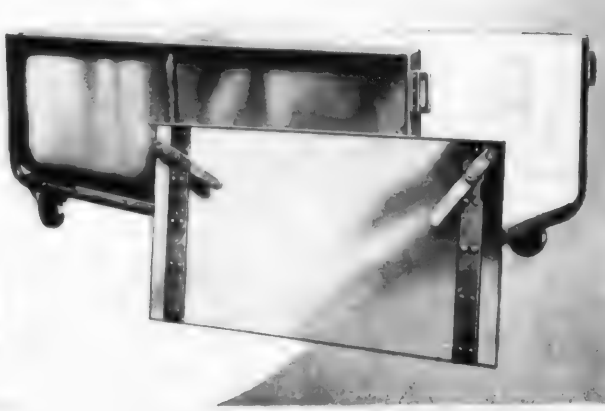
Phone : 4925 (2 lines) **Grams : Filling, Bolton**

BRABY

ALUMINIUM TRUCKS

Aluminium Truck for Fine Chemicals. Removable body with mild steel tubular frame.

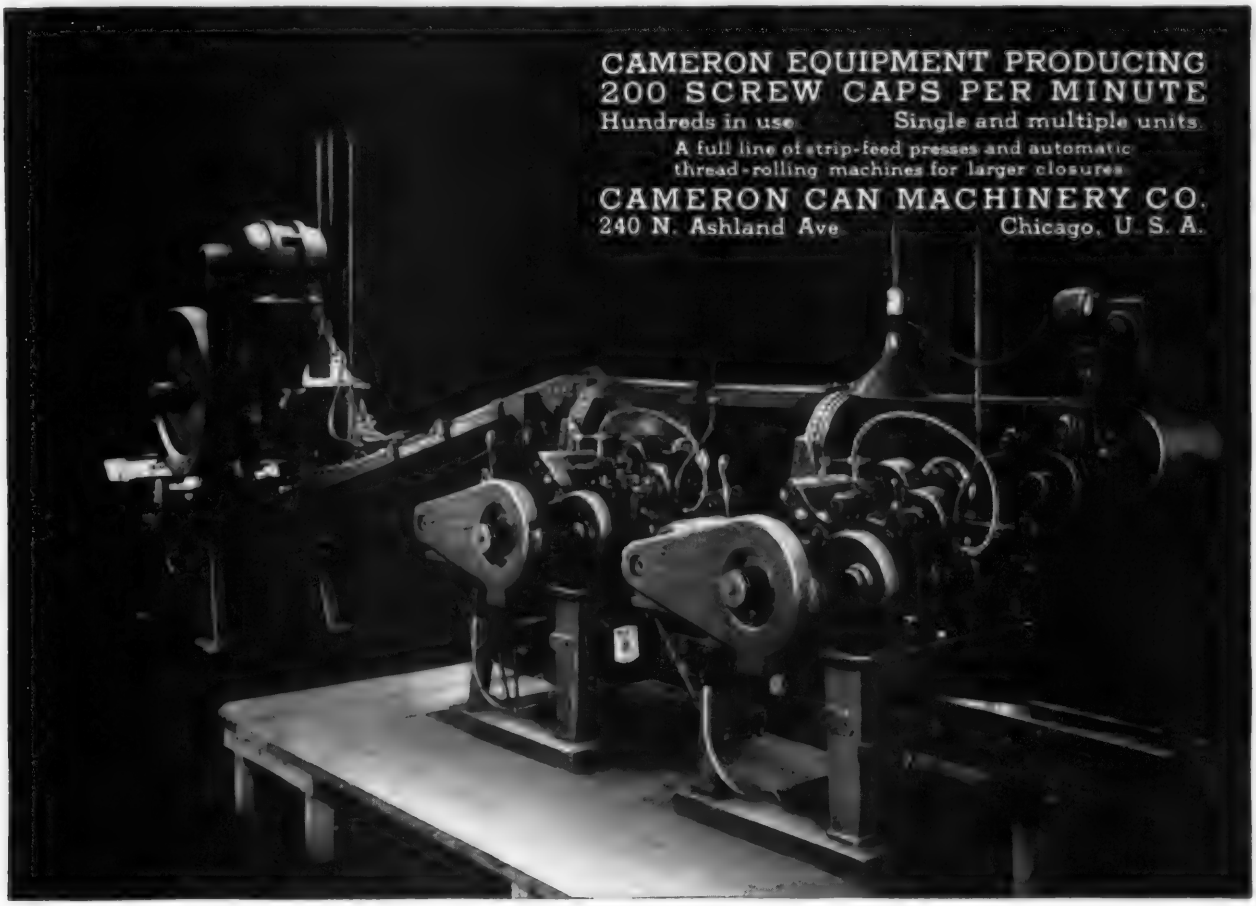
Aluminium Margarine Truck with removable end.



Ideal for easy handling of Goods in Factory or Warehouse. Essential cleanliness and purity of product facilitated. Enquiries invited. State purpose and special requirements. Two typical examples are illustrated.

FRED^K BRABY & CO LD

Ashton Gate Works, Winterstoke Road, Bristol, 3.
Head Office :- 352-364 Euston Road, London, N.W.1.
and at Deptford, Liverpool, Glasgow, etc.


CAMERON EQUIPMENT PRODUCING
200 SCREW CAPS PER MINUTE
Hundreds in use Single and multiple units
A full line of strip-feed presses and automatic thread-rolling machines for larger closures
CAMERON CAN MACHINERY CO.
240 N. Ashland Ave Chicago, U. S. A.

We have made this equipment for many years and over 500 Cameron Screwing Machines are in operation, producing millions of closures each day. We would be pleased to submit advice on your closure problems. Every machine for can-makers.

Cameron

CAN MACHINERY CO.

240 NORTH ASHLAND AVENUE

CHICAGO ILLINOIS

M-177

PERFECT FLAVOUR ... *always*

Eliminate uncertainty—and you have an unvarying standard.

That is what we have done with ELPEX apple Pectin—set an unvarying standard of strength and maintained it.

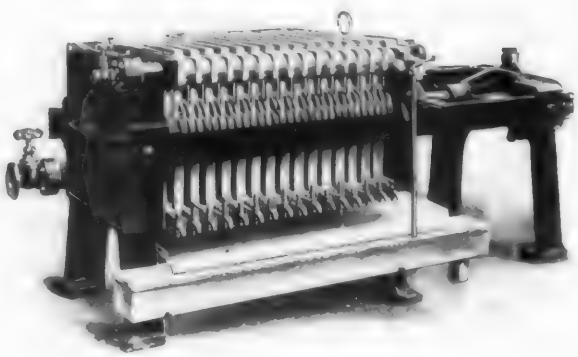
Use ELPEX and know that the perfect flavour of your jams will be as constant as you could wish it to be.

A trial order will prove the superiority of ELPEX, the Pectin which has proved its worth to the Trade during the past 22 years.

Elpex
APPLE PECTIN

WILLIAM EVANS & CO.
(Hereford & Devon) **LTD.**
20, WIDEMARSH, HEREFORD
Est. 1850

"JOHNSON" FILTER PRESSES



ARE SUCCESSFULLY AND EXTENSIVELY USED BY ALL THE LEADING AND MANY SMALL MANUFACTURERS OF JAMS, MARMALADES, ETC., BOTH IN GREAT BRITAIN AND ABROAD.

Being designed specially to meet individual requirements they are perfectly satisfactory for the filtration of Sugar Syrup, Fruit Pulps and Juices, Wines, Ciders, Beer, Yeast, Soups, Meat Extracts, Oils and all classes of foodstuffs where a refined product is required.

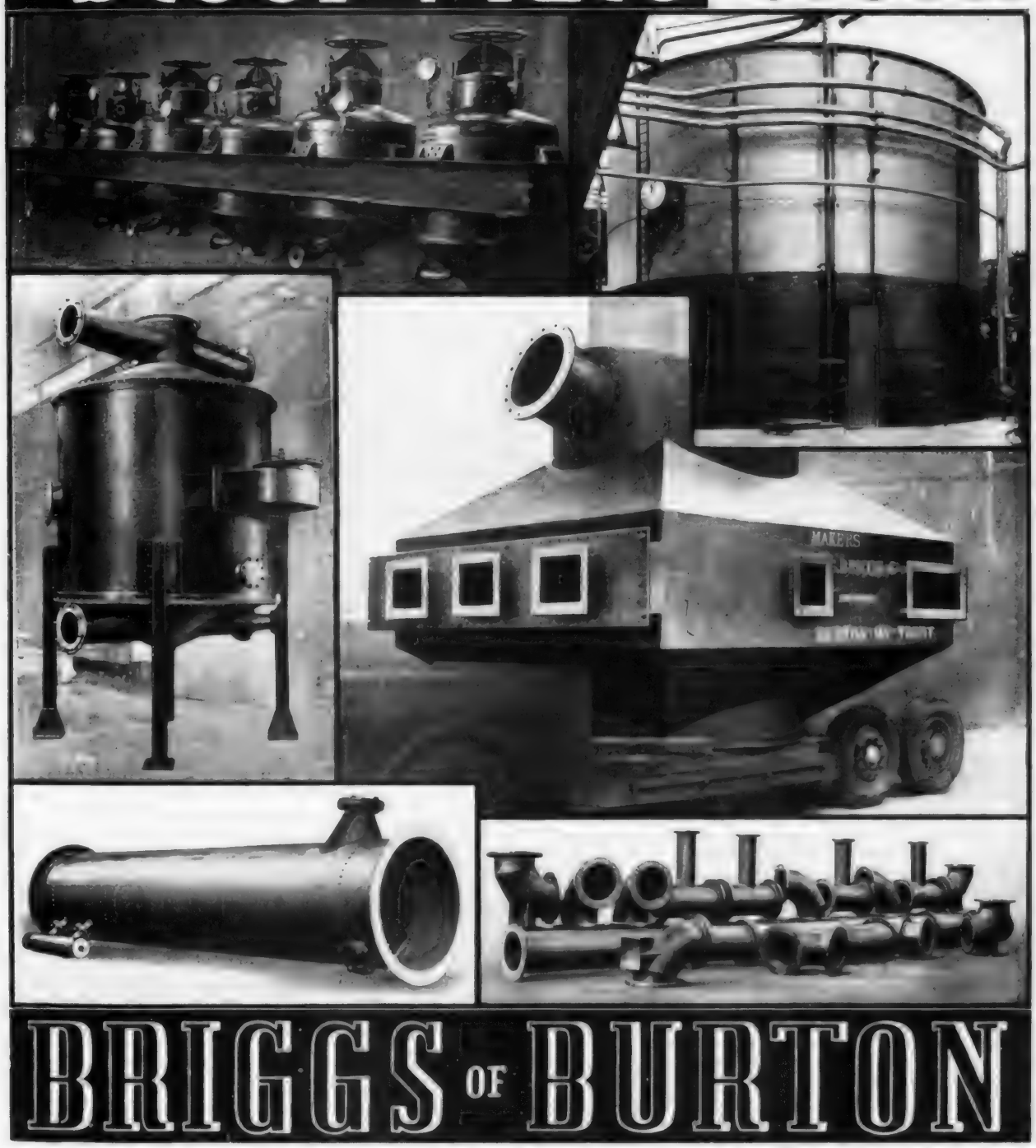
TESTS MADE ON ANY SAMPLES SUBMITTED

S. H. JOHNSON & CO., LTD.

DEPT. "K.", CARPENTERS ROAD, LONDON, E. 15

'PHONE : MARYLAND 1863 *'Grams : "FILTRUM, 'PHONE, LONDON"*

Steel Plate Work



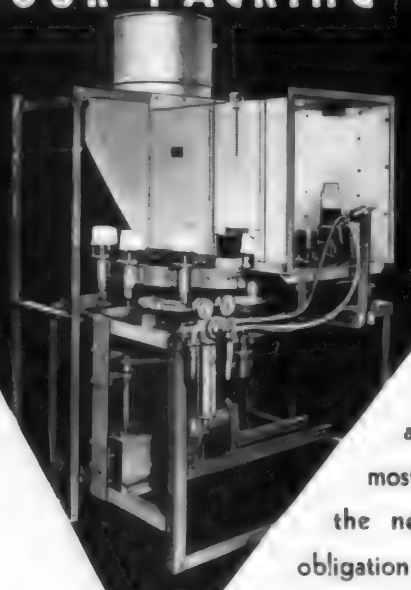
BRIGGS OF BURTON

S. BRIGGS & CO., LTD. ENGINEERS, FOUNDERS AND COPPERSMITHS **BURTON-ON-TRENT** Phone . . . . . Burton-on-Trent 2232 Grams . Briggs, Engineers, Burton-on-Trent

INCORPORATING

THORNEWILL & WARHAM LTD. ENGINEERS, BOILER MAKERS AND MILLWRIGHTS **BURTON-ON-TRENT** Phone . . . . Burton-on-Trent 2881 Grams "Thornewills," Burton-on-Trent

SEND YOUR PACKING TROUBLES PACKING . . .



Aerograph Automatic Spraying Machines are made in a wide range of types and sizes for applying wax solutions and protective hygienic finishes to cartons and food containers. You are invited to discuss your own particular packing problems with one of our engineers, and if you will let us know the time and place most convenient to you, we will gladly make the necessary arrangements. There is, of course, no obligation involved.

THE AEROGRAPH COMPANY LIMITED.

Lower Sydenham, London, S.E. 26 Telephones: Sydenham 6060 (8 lines)

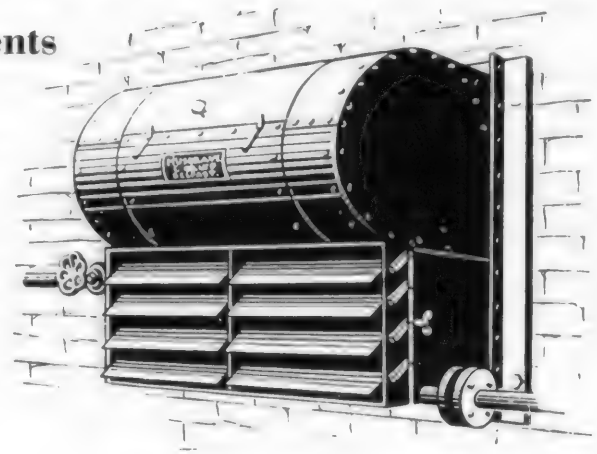
C.V.S. 170

HEATING and VENTILATION

To Factories Act Requirements

Check up on your production figures during cold weather. You will realise that to be without an effective system of heating is a serious business liability.

Consult Musgrave's with regard to your particular heating problem. They will be pleased to advise you on the most suitable, efficient and economical installation best adapted to your needs.



The Musgrave Pure Air Unit is a combined heating unit and air filter, designed to give a supply of warmed fresh air free from all impurities.

Also STOVES, HOT WATER, STEAM AND FAN SYSTEMS

Musgrave

AND COMPANY LIMITED

ST. ANN'S IRONWORKS, BELFAST

London, Cardiff, Glasgow, Manchester, Bristol

S. African Agents : The Dryden Engineering Co., Ltd., Box 815, Johannesburg.

S. American Agent : Mr. Charles P. Dixon, Calle Sarmiento 470, Buenos Aires, Argentine Republic.

FIBREEN PACKING
costs you less than other materials

The rising cost and general shortage of canvas, hessian, timber and other materials used for packing purposes make the unusual qualities and reasonable price of FIBREEN of vital importance to manufacturers. In strength and utility FIBREEN is unique. It can be made into sacks and bags; replace expensive tinfoil or similar material as a lining for kegs, drums, boxes, bales or crates, and is ideal for packing all types of products which must be kept moisture-proof. So tough is FIBREEN that it can replace to a large extent timber used in boxes or crates, by simply nailing it to a wooden framework or as a cover for fibre or cardboard boxes in lieu of timber.

FIBREEN consists of two layers of kraft, two inner layers of bitumen and two crossed layers of sisal fibre—forming a composite flexible material of enduring strength which is impervious to water, dust, grease, fungi, ants or other insects.
Investigate this ECONOMICAL and SAFE way of packing goods. May we send working sample together with prices and further information.

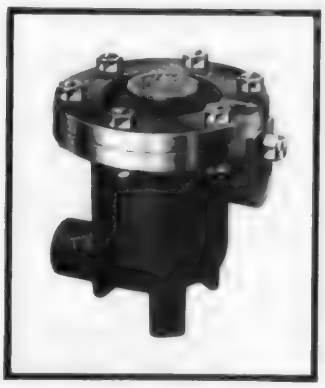
FIBREEN

Trade Mark

THE PERFECT PACKING PAPER

ALDWYCH HOUSE, ALDWYCH, LONDON, W.C. 2
Telephone: HOLborn 6949 (4 lines)
Telegrams: BRICKWORK, Estrand, London

J. H. SANKEY & SON, LTD.
Est. 1857



The **DOME**

THE **IDEAL** STEAM TRAP
FOR THE
FOOD INDUSTRY
LARGE CAPACITY
LONG TROUBLE-FREE SERVICE
LOW PRICED
Send for list F.M.445 and Prices

ALSO OF INTEREST
CENTRIFUGAL PUMPS. FEED-WATER HEATERS. CALORIFIERS. BOILING JETS. AUTOMATIC MEASURING TANKS EXHAUST HEADS.
New General Catalogue F.M.400 on request.

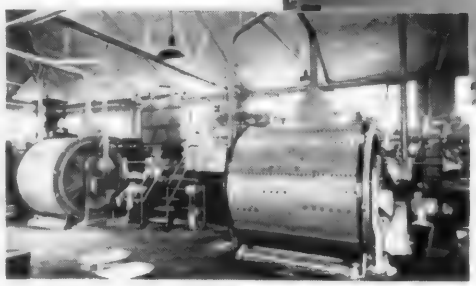
HOLDEN & BROOKE, LTD.
SIRIUS WORKS, MANCHESTER, 12
and
66 VICTORIA ST., LONDON, S.W. 1

G.E.C.
ELECTRICAL EQUIPMENT
FOR FOOD FACTORIES

—more important than ever now that output must be maintained at high levels.

Two grinders and a small blender driven by G.E.C. motors—15 h.p., 5 h.p. and 4½ h.p. respectively

Two views at the GLAXO LABORATORIES



Two blenders, one 1 ton and 1½ tons capacity, driven by 5 h.p. (450 r.p.m.) and 6 h.p. (970 r.p.m.) slip-ring motors respectively

Get into touch with your nearest G.E.C. branch.

ABERDEEN	*BOURNEMOUTH	CARDIFF	EDINBURGH	IPSWICH	LUTON	NORTHAMPTON	SHEFFIELD
BELFAST	*BRADFORD	CORK	GLASGOW	LEEDS	MANCHESTER	NOTTINGHAM	SOUTHAMPTON
BIRMINGHAM	BRIGHTON	CROYDON	GLOUCESTER	LEICESTER	MIDDLESBROUGH	PLYMOUTH	STOKE-ON-TRENT
BLACKBURN	BRISTOL	DUBLIN	HULL	LIVERPOOL	NEWCASTLE-ON-TYNE	READING	SWANSEA
BLACKPOOL	CANTERBURY	DUNDEE	INVERNESS	LONDONDERRY			

* *Osram Lamp Sales Depots only.*

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C. 2

GLYCERINE

MANCHESTER DISTILLATION PLANT

The purest Quality on the Market

CHEMICALLY PURE B.P. PALE STRAW

Produced by

THOMAS HEDLEY & COMPANY LTD
TRAFFORD PARK
MANCHESTER

Sole Distributors:

FREDK. BOEHM, LTD., 17, JEWRY ST., LONDON, E.C.3
and 140 WEST GEORGE STREET, GLASGOW

WE SPECIALISE IN
CONDENSING PLANT for MILK, WHEY, CARAPHYLL, Etc., in COPPER or STAINLESS STEEL.

The Plant illustrated shows our latest installation incorporating a Stainless Steel Evaporator and Sugar Dissolver.

Latest pattern, double-acting, central inlet Vacuum Pump and Interceptor to arrest and collect all entrainment to prevent pollution of the condenser water.

ROBERT MORTON & CO., LTD.

Manufacturers of all kinds of Plant for Food Factories, Dairies, etc.

BURTON-ON-TRENT

Telephone: Burton-on-Trent 3033-4 Telegrams: "Morton, Burton-on-Trent."

Illustration by courtesy of Messrs. Henry Edwards & Sons, Ltd., Pipe Gate, near Market Drayton.

GLASS

A Container Problem to be solved?

For Hygiene and Appearance

Pack in

Canning Town Glass Containers

CANNING TOWN GLASS WORKS LTD.

GLASS BOTTLE MANUFACTURERS

NEW BRIDGE STREET HOUSE, 30/34 NEW BRIDGE STREET, E.C.4

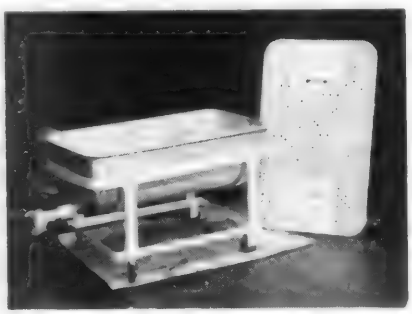
Telephone: CENTRAL 5342-5 Telegrams: DRYAD, LUD, LONDON

FACTORIES: CANNING TOWN, E.16 AND QUEENBOROUGH, KENT

RANDALL'S
For TRACTABLE TROLLEYS

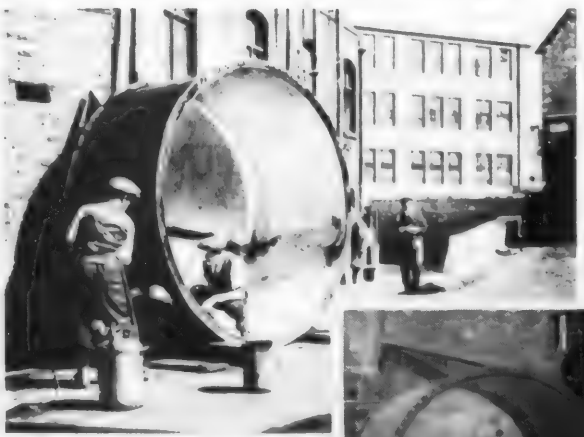
Randall Trolleys and Trucks are easily manœuvrable and easy running. They're strongly constructed and will stand a lot of misuse. There are types for all trades within the food industry, and if a standard pattern is not quite the thing for your products or processes we'll design the one kind which will be just right for the job.

The illustrations here show how wide is the range of Randall abilities. The mobile trough in the smaller picture is for liquids. Aluminium, for freedom from contamination and for lightness, it has no acute corners nor crevices and has a thoroughly hygienic, quickly-acting outlet. *N.B.—Aluminium being now controlled, supplies are available only for direct Government contracts.*



The larger photograph is one of a number of pastry trolleys with swivel castors which we supplied to what is probably the biggest bakery business in the world.

and TINNING...



Even this wasn't too big for Randall's to tin.

Randall tinning is a special process devised during an experience extending towards a hundred years. Randall tinning and re-tinning last longer and cannot flake. By their Alloy-Coat Hot Process the tin is fused to the base-metal. It is the most economical method of providing or renewing corrosion-resistant surfaces for food processing or storage equipment. We can tin anything from a soup ladle to 24-ft. pipes or plant such as that shown in our photographs.

Some tanks for an oil cracking plant turned 13 years ago and still good.

AND AT
3 BELGRAVE GARDENS, ST. JOHN'S WOOD, N.W.8
Phone: **MAIDA VALE 1466**

James H. RANDALL & SON LTD
Established 1851
PADDINGTON GREEN WORKS, NORTH WHARF ROAD, LONDON, W.2.
Telephone: AMBASSADOR (5611-2-3-4 (4 lines) Telegrams: RANSOMPAD, PAD

A JOURNAL DEVOTED TO THE PRODUCTION AND MANUFACTURE OF ALL EDIBLE COMMODITIES INVOLVING A PROCESS OF MANUFACTURE.

FOOD MANUFACTURE

Incorporating Canning, Packing and Preserving.

VOLUME . . . XV

NUMBER . . . 1

JANUARY 5. 1940

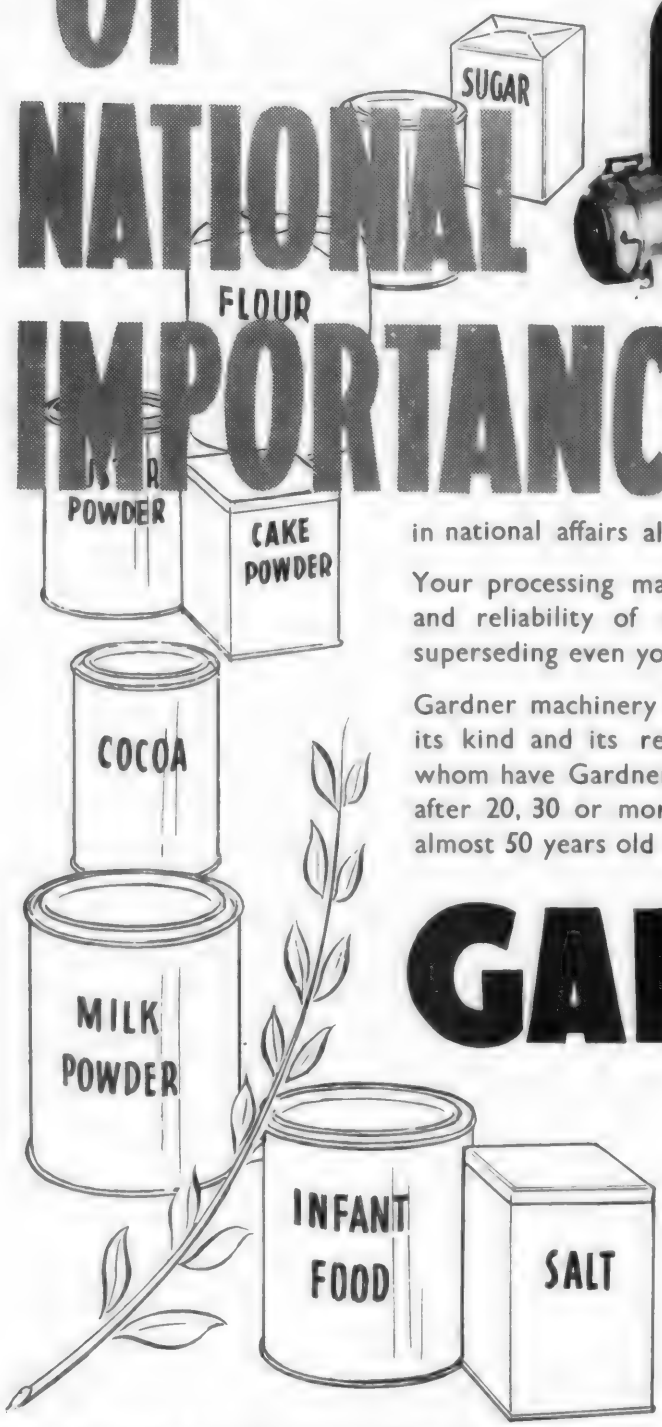
CONTENTS

	PAGE
Editorial	1
Aids to Fuel Economy. *H. C. Appleby* . .	5
Metals in the Food Industry: A Symposium .	8
Hydrogen Swells. *Specially Contributed* . .	14
"Canned Foods in Relation to Health." *Reviewed by Professor J. C. Drummond* .	17
Vitaminising Foodstuffs. *Dr. Ing. Emil Collett, M.N.C.S., M.P.F., M.N.I.F.* . . .	19
Book Reviews	22
Plant and Machinery	23
Information and Advice	25
Recent Patents	26

Published on the first Friday of every month by Leonard Hill Limited, 17, Stratford Place, London, W. 1. Telephone: Mayfair 7383 (Private Branch Exchange). Annual Subscription, 10s.; Abroad, 12s. 6d.; Single copies, 1s.

The Editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings when possible.

A MATTER OF NATIONAL IMPORTANCE



• • • Food has assumed a status in national affairs almost as great as that of munitions of war.

Your processing machinery is becoming increasingly important and reliability of machinery a matter of national interest superseding even your own.

Gardner machinery for Food processing is the most efficient of its kind and its reliability is vouched for by users, some of whom have Gardner machines still giving **satisfactory** service after 20, 30 or more years of use. (We know of one that is almost 50 years old and still working regularly.)

GARDNER

Patent "Rapid" SIFTERS, MIXERS, combined SIFTERS and MIXERS, patent "Quick-Change" FINE POWDER DRESSERS, Liquid Spraying Apparatus, DRYERS, CEREAL COOKERS, MILLS, ELEVATORS, etc.

WM. GARDNER & SONS (GLOUCESTER) **LTD., Bristol Road, Gloucester.** *Phone: 2288 (3 lines). Grams: "Gardner, Gloucester."*
LONDON: 19 Gray's Inn Chambers, 20 High Holborn, W.C.1 - - *Telephone: Chancery 7347*

Facing first page of Editorial

FOOD MANUFACTURE

Vol. XV, No. 1 January 5, 1940

1940

LAST YEAR at this time we had not long emerged from a crisis. The optimists breathed freely, but there were many who viewed the time as the beginning of a short respite, although perhaps not quite so short as it turned out. We are now in the midst of the greatest struggle in history, but whatever clash of opinions there may be on any other subject under the sun there is but one in this Empire about the war, and that is WE ARE GOING TO WIN.

The administrative and executive staffs of the food industry are "living laborious days", knowing full well the outstanding *rôle* that food will play in the fight. They do not grumble—or not much—at the inevitable inconveniences due to special circumstances and sometimes to the evitable mistakes of others—they are much too busy. When the tale is finally told, there will be many in the industry who will not figure on an Honours List, but they will have truly served.

Macon

The mention of cured and smoked mutton by an M.P. brought a flood of correspondence in the Press. It was no new thing. It was a commonplace in Perthshire and other places. It had been known almost from time immemorial. As a matter of fact it is one of the national dishes of Finland.

Two years ago a well-known firm of bacon curers made extensive experiments (which they are now resuming) and produced an article which we had the opportunity of sampling. Although the firm in question had encountered sundry difficulties and were themselves not completely satisfied with results, we found the product good. The term "cold mutton" does not conjure up visions of gastronomic delight, but apart from anything else, smoked mutton is widely different from the leftover of Sunday's dinner, and with a small addition of imagination as sauce makes a tolerable substitute for ham.

Dextrose-Packed Fruits

Peaches, pears, apricots, and fresh prunes will be the items packed in the U.S.A. this year.

Mr. Paul Cooter, of the Cooter Brokerage Company, Chicago, said at a recent meeting of wholesalers: "It is indeed an experience to run across something new in the preparation of canned fruits. Rarely have I come across any new development as noticeable from the standpoint of flavour as this method of packing fruits with dextrose. To me it constitutes another major scientific advancement by the food canning industry—bringing a better and more flavourable canned product to the consumer." Citrus fruits have already been packed with dextrose. The "dextrose story" is a double one—it stresses flavour and "food energy sugar".

Dried Grass for Cattle

Mr. T. S. Bennett, of Manor Farm, Lower Wick, Worcester, has a Billingham drier which he has used for four years, and during that time he has dried nearly 1,000 tons of grass. According to the *Farmer's Weekly* various experiments have been tried at Lower Wick with regard to the work of drying. It has been said by some critics of the system that the continuous and intensive cutting of pastures leads to a rapid deterioration of the herbage. Mr. Bennett's usual procedure is to cut and graze in alternate years. One field, however, has been cut continuously since 1936, and during these four years it has yielded eleven crops. In 1936, a wet summer, it averaged 58 cwts. per acre, and in 1939, under similar weather conditions, it yielded 63 cwts. per acre. During that time a careful examination of the herbage shows that the composition of the grasses has actually improved. Tests have been made with regard to the effect of dried grass upon the stock. The health of the milking cows has improved during the last four years. Moreover, the dried grass gives a far better colour to the milk in winter-time.

Differentiation of Salmonella Organisms

The value of the sodium dextro-tartrate fermentation test in the differentiation of *salmonella* organisms is described by S. W. Challinor and A. J. Rhodes in the *Journal of Hygiene*, Vol. 39, 6. The authors have confirmed the observations of Brown *et al.* (1924-5) that *B. paratyphosus* fails to ferment, while *B. aertrycke* and food-poisoning organisms do ferment, sodium dextro-tartrate. They find that by a slightly modified procedure provisional results are obtained 48 hours sooner than when the exact technique of Brown *et al.* is followed, and that the application of this test is of definite practical value in differentiating between *B. paratyphosus* and other *salmonella* strains in the group phase.

A Nice Cup of Tea

Doctors have for generations laid at the door of the all-prevailing social habit of tea drinking the responsibility of many minor digestive ailments. The argument goes something like this: tannin coagulates protein, tea contains tannin, therefore tea is also a coagulator of protein. This widespread view has recently had a nasty knock at the hands of Halpenny and MacDermot (*Canadian Medical Journal*, November, 1939). These workers, using modern laboratory technique, barium meals, basal metabolic rates and gastroscopy, have actually concluded that good tea, brewed for five minutes, produces mild and pleasant stimulation, in no sense corresponding with the violent, unpleasant action of its main components, caffeine and tannin, when these are given separately or in combination. They have found that the effects of tea on gastric acidity and peptic activity are slight and variable, and that it certainly does not increase acidity and it does not alter the basal metabolic rate. They have concluded that the quality of tea cannot be judged by chemical analyses and that the importance of the tea taster is still supreme. Many tea drinkers who have in the past hurriedly and surreptitiously removed the teapot on the advent of the doctor will now take heart and consume their cups unashamedly.

Whipping Substance from Soya Bean

The substance responsible for the whipping of undenatured, solvent-extracted soya bean flour is not glycinin. The whipping substance is extracted from the flour at *p*H 5·0, the isoelectric point of glycinin. This extract whips more readily and to a much greater volume than suspensions of the original flour; it has a better flavour and can successfully be used in place of egg white in many food preparations. About 87 per cent. of the weight of flour is obtained as soluble extract. The residue may be used for the preparation of glycinin. Betty M. Watts and Doris Ulrich, of the University of California, Berkeley, California, discuss this matter fully in *Industrial and Engineering Chemistry*, Vol. 31, 10.

Pedigree Poultry

The humble hen has been lately in the limelight. "A group of pedigree utility poultry breeders, with substantial interest in the breeding industry, met in London last week to consider how breeders could assist the Government in conserving supplies of foodstuffs, and at the same time maintain the essential stocks of the country to provide pullets of the most economical type during the war and for development on a sound foundation at a later date," *The Times* recently stated. It was agreed to represent to the authorities the vital importance of reducing stocks of little productive value, and it was considered that the breeding industry would co-operate to the fullest extent in this important measure. It is essential that only pullets bred from stock of proved laying capacity should be kept and fed on available supplies (which are scarce), and obviously both the poultry industry and the nation will derive advantage from a campaign for the survival of the fittest stock in the country. At the meeting referred to, support was given to a proposal for setting up an association of pedigree utility poultry breeders, distinct from the existing organisation of accredited poultry breeders, because the vast majority of the leading breeders of the country are outside the accreditation movement.

The Testing of Lard

The examination of lard for genuineness or adulteration, always a difficult problem, is now, for reasons stated by R. W. Sutton, A. Barraclough, R. Mallinder, and O. Hitchen, at the December 6 meeting of the Society of Public Analysts, more difficult than formerly. The ordinary routine fat constants are insufficient for this purpose, and the only one determined by the authors on all samples of lard are the iodine value and the refractive index; distribution tables showing the variation of these two values amongst more than 100 samples of lard examined since 1933 are given. If normal, these values do not prove that a

sample is genuine, and if abnormal they do little more than emphasise the necessity for further investigation. Of special tests for adulteration the following four are discussed, with data, and recommended: (1) The Bömer Test. The procedure described in the A.O.A.C. Book of Methods, using acetone as solvent, and the recommended standard for genuine lard, $M_g + 2d = 73°$ or more, have been found very useful; attempts to apply the method quantitatively are described. (2) Tests for hardened oils or fats by determination of iso-oleic acid. Of three methods tested, that of Twitchell is preferred. (3) Detection of vegetable oils or fats, from the melting point of the sterol acetate. (4) Microscopical examination of crystals from an ethereal solution of the sample under standardised conditions.

Poultry Advisory Committee

Much disappointment has been expressed and criticism made because of the omission of any veterinarian from the Poultry Advisory Committee recently set up to give advice on matters affecting the interests of the poultry industry under wartime conditions. The National Veterinary Medical Association made strong representations to the Minister of Agriculture urging that this regrettable oversight should be remedied. These were apparently successful, as we learn that the two additional appointments now made include that of Professor T. Dalling, M.A., M.R.C.V.S., Professor of Animal Pathology in the University of Cambridge, who is Chairman of the Association's Advisory Committee on Poultry Diseases. The other appointment is that of Captain Guy Clifford, a Lancashire poultry farmer, who is Vice-President of the National Poultry Council. Both these appointments should have far-reaching effects, and it is a pleasure to note that at last the Government have decided to abandon the time-honoured practice of trying to fit square pegs into round holes and have actually appointed to a committee two persons who really understand something about what the committee is supposed to do.

"Mindal"

Mindal, the Meat Importers National Defence Association, Ltd., has started operations. It is an association which includes every meat-importing firm in the country.

The outbreak of war throws all the world's markets into a flurry. If the meat importers in this country had continued to compete against each other for meat supplies in the normal way, supplies would have been uncertain and prices would have risen steeply.

The Ministry of Food has become, therefore, the sole importer of meat and makes bulk contracts with our oversea suppliers. The Ministry, however, wants expert help for the handling of this meat, which amounts to a million tons a year, and the meat importers have formed themselves into an association—"Mindal"—to carry out this work. The association will act as the agent of the Ministry and will make arrangements for handling imported meat with its constituent members. It will receive a fee for doing so, from which the expenses of the Association must be met.

The arrangement has two great advantages, according to the Ministry. The Government and the consumer benefit from the expert services rendered by members of the trade; on the other hand, in spite of Government control of imported meat, the essential peace-time machinery of the importing firm is kept in being so that the firms can resume their normal functioning at the end of the war.

Soil Erosion

Erosion is probably the greatest single factor causing loss of soil fertility. A large percentage of the available plant food in soil is present in the weathered surface layer and may be permanently lost through the removal of that layer by erosion. A familiar example is observed in the loss of productivity caused by the formation of gullies; but the loss which accompanies the gradual uniform removal of surface soil by sheet erosion, while not so apparent, is very important. The effect of sheet erosion in reducing soil fertility is clearly demonstrated by the results of an experiment which has been in operation for four years at the Central Experiment Farm, Ottawa, described in a leaflet issued by the Canadian Department of Agriculture. In this test the effect of varying degrees of erosion in crop growth has been determined by growing barley on plots from which different amounts of the surface soil have been removed. This dark surface soil is approximately seven inches deep, overlying lighter-coloured subsoil. The results indicate that the loss in productivity accompanying soil erosion has increased rapidly in proportion to the depth of surface soil removed, the productivity of the exposed subsoil being less than one-seventh that of undisturbed surface soil. When none of the surface soil was removed the yield was 39·5 bushels per acre, but when it was all removed the yield fell to 5·2 bushels only.

Nitrite in Meat Curing

The Provisional Order of the Ministry of Health permitting the use of nitrites in the curing of meats has now been published and those interested will have made themselves familiar with its contents. That it is a step in the right direction and one long overdue will readily be admitted, as also will the facts that it will make possible a quicker output of cured meats, accompanied with improvement in quality. Further, it has at last placed manufacturers in this country on an equal footing with their competitors abroad.

Cursory consideration of the matter would seem to indicate that all that was necessary for the Ministry to do was to grant the permission which had been sought for by the Food Manufacturers Federation, the most influential body of food producers in the British Isles. Careful study of the subject shows that it is by no means simple and that a number of aspects had to be investigated before a decision could be taken.

Regarded from the producer's point of view the position was this: Whenever nitrate was used in cure, nitrite was certain to be formed; in fact, cure cannot take place until it is formed, so why worry about its presence and whether it was formed from nitrate or whether it was added as such, for in both cases a residue would remain in the meat? Further, when nitrite is added a very strict control upon the amount used can be maintained, but no such control is possible when the production of nitrite from nitrate forms the source of the former substance. It would seem therefore that there was no reason why the use of nitrite should need any sanction by the Ministry of Health.

Ministry of Health's View

From the Ministry of Health's point of view there were some difficulties to be overcome, among which were the following:

That nitrite in itself is a poisonous substance if taken in a sufficiently large dose, and if permission for the use of nitrite were to be given there must be some safeguard against its indiscriminate use, otherwise some injury to the health of the public might ensue.

That nitrites were not included in the list of permitted substances in the Preservative Regulations, and if nitrite was in fact a preservative its direct use as such contravened those Regulations. It was therefore desirable that they should satisfy themselves that nitrites played no part in the preservation of meat, even in the very small amounts in which they were present in cured meats.

That the manufacturers of bacon and hams were not willing to forgo the use of nitrate in their curing process so that it was virtually impossible to place a limit upon the amount of nitrite which could be permitted in these articles, and the best that could be done was to stipulate that the amount of nitrite should not be such as to be injurious to health. Exactly what such an amount is has apparently not been decided, but imported bacon and hams have been examined and found to contain amounts up to 2,000 parts per million of potassium nitrite.

That nitrite-cured meats had been imported into this country for many years and had passed the Customs authorities without any comment, and, of course, without any limit being placed upon the amount of nitrite which they might contain.

The Provisional Order

The Ministry of Health faced this awkward situation by the issue of the Provisional Order which places a maximum limit of 200 parts per million upon the amount of nitrite which can be permitted in all cured meats and meat products other than bacon and hams. In regard to these, the amount of nitrite present shall not be such as to be injurious to health.

It should be understood that curers can, if they so wish, continue to use nitrate, with or without the addition of nitrite, or, if they desire to do so, may use nitrite only. Should they be producing meat products other than bacon and hams, the amount of nitrite in the articles as offered for sale shall not exceed 200 parts per million. If they are manufacturers of bacon and hams, then the amount of nitrite in such substances shall not be sufficient to be injurious to health.

Examination of very many samples of cured meats, other than bacon and hams, whether cured with nitrate or nitrite has shown that a figure of 100 to 150 parts per million of nitrite is hardly ever exceeded, and that bacon and hams which are produced in this country fall under the 450 parts per million. The same cannot be said in regard to the imported articles, in some samples of which the figures are above 1,000 parts per million. It would appear possible that it is the importers of bacon and hams who should endeavour to control more closely the amount of nitrite which may be present in their products.

A Happy New Year to all Readers

AIDS TO FUEL ECONOMY

During the past year there have been considerable improvements in the design of instruments and other devices for boiler-house use. This article, written by a practical combustion engineer, describes some outstanding examples of such devices for fuel economy seen by him under actual working conditions.

H. C. APPLEBY

THE COST of fuel for industrial purposes is again in the limelight as a result of enhanced prices. Factory executives who in the past have turned deaf ears to the call for the scientific use of coal in the boiler-house are now able, if they will see the error of their ways, to secure greater savings in their power production and steam processing departments. While there have been improved methods of generating steam which they might have put into practice years ago, they now have the opportunity, if they wish to commence to operate on more economical lines, of taking their choice of combustion appliances quite recently introduced, as well as those which have proved, through years of hard wear, their reliability and stability. In cases where works managers have lacked expert knowledge of combustion engineering, they may have acquired apparatus which has not fulfilled the functions claimed for them, thereby producing a lack of faith in any kind of combustion aid.

A Specialist's Job

Combustion engineering is a specialist's work, and specialised advice on steam generation, if acted upon, cannot fail to produce satisfactory results in the way of lower production costs. The author has attempted to point out in a previous article* how much can be done to economise fuel in most boiler-houses. That article was confined to actual firing practice and general maintenance of boiler plant, with only two recommendations for purchase of plant—viz., automatic stokers and gas analysis apparatus.

This article deals with fairly recent additions to appliances introduced as aids to fuel economy, and, while it is obviously impossible to deal with all apparatus designed for that purpose, some representative types will be described.

Master Control Panel for Automatic Boiler Control which will maintain efficiency within 1 per cent. of test performance in day to day operation.

(George Kent, Ltd.)

Boiler-House Control Panels

During the last year there have been improvements in the design of instruments for boiler-house use, and boiler-house control panels suitably equipped to give all necessary information on pressures, CO_2, water and steam flow, temperatures around the boiler settings, steam-air ratio and boiler water levels, etc., are now available.

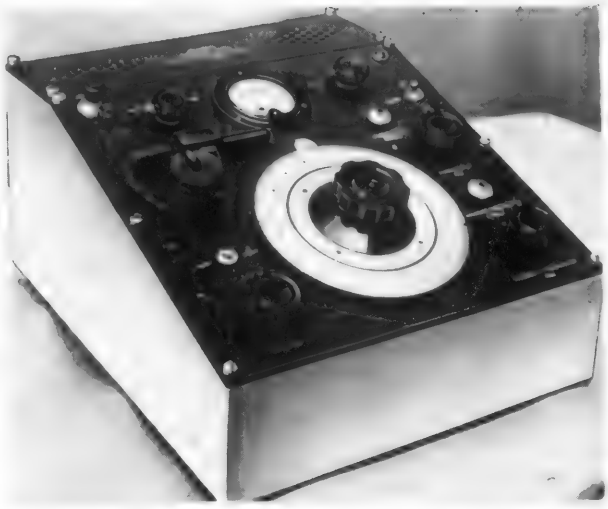
One of these is the recently introduced system of automatic boiler control capable of facilitating the production of cheap steam on either large or small plants. The operation of the control is essentially simple, and the prominent features are that (1) a master controller determines the rate of evaporation by controlling the induced draught or the damper at the stack; (2) the furnace pressure controller maintains a constant suction in the combustion chamber by adjusting the forced draught supply; (3) the fuel air controller measures the air supply continuously and adjusts the fuel supply to give the best possible combustion conditions.

An important feature is the independent operation of any portion of the system to allow periodical testing of any unit, because the induced draught, forced draught or fuel supply can each be operated manually, and provision has been made for installing either of two controlling systems, one worked electrically, the other by hydraulic arrangement.

CO_2 Recording

A CO_2 recorder, which represents a type of instrument which is invaluable in the boiler house, and is so designed as to obviate the need for periodical changes of absorptic n solutions, is based on the thermal conductivity of gases. When a heated wire is placed in an atmosphere of gas, it loses heat by radiation, conduction and con-

* Food Manufacture, *April*, 1939.



A mains-operated *p*H meter for general use in laboratory and works. The scale is direct reading, either in *p*H values over a range of 0 to 14 or in millivolts over a range of 0 to 1,500 according to the setting of a switch.

(Marconi-Ekco Instruments, Ltd.)

vection. If the first and last factors are kept constant, the heat loss is dependent on the composition of the gas, owing to the different thermal conductivities of various gases. As an instance, the thermal conductivity of CO_2 is only about half as great as that of air. If a constant heat input is supplied to the wire, there will be an equilibrium temperature for each mixture of gases present, and, assuming only one variable—CO_2 concentration—this concentration can be found by measuring the temperature of the wire. In the CO_2 recorder working on this system gas is passed through a measuring cell containing a glass-coated platinum wire, heated electrically, and this is placed in one arm of a Wheatstone Bridge, in another of which is a similar cell which is sealed and contains ordinary air. A difference in CO_2 content of the gases in the two cells causes a difference in the temperature of the wires, and hence a difference in resistance of the two arms of the Bridge, and the out-of-balance potential of this Bridge is measured by a recording potentiometer as CO_2. With this instrument the makers claim that a constant accuracy of plus or minus $\frac{1}{2}$ per cent. CO_2 is obtained under normal working conditions.

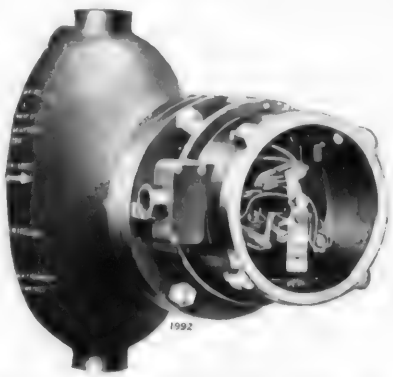
Illuminated Moving Scale Indicator, which enables readings to be taken from a distance. Used for CO_2 in boiler gases or as a temperature indicator.

(Cambridge Instrument Co., Ltd.)

Boiler Water Feed Treatment

In recent years a great deal of research and attention has been directed to obtaining economically a chemically treated water comparable to a commercially distilled supply so far as hardness and solids are concerned, and the Permutit Company, Ltd., has now been successful in this quest.

To all appearances the plant required to achieve this result resembles very closely the well-known sodium base-exchange unit, two pressure type units being called into service, through which the water passes in series. The first unit contains a carbonaceous material which is sold under the trade name "Permutit" Zeo-Karb H.I., and which is unique in that it will remove all cations—*e.g.*, calcium, magnesium, sodium, etc. Following this treatment the water contains only the equivalent amount of acids—*i.e.*, carbon dioxide resulting from the bicarbonates, sulphuric acid from the sulphates and hydrochloric acid from the chlorides. Such a water is strongly acid, and to complete the treatment the water then passes



Float Switch with 2-6 amp. mercury tubes and 1-15 amp. tube operated through adjustable differential mechanism.

(Drayton Regulator and Instrument Co., Ltd.)

through the second unit, which contains a bed of demineralising material, and this removes the whole of the acids contained in the water other than the carbon dioxide, which latter can readily be removed later by simple aeration or degassing.

Sulphuric acid is used for regenerating the first unit, and an alkali such as carbonate of soda or caustic soda is employed in regenerating the second unit.

An interesting development of this new process is that a water of any desired alkalinity can be obtained by operating the Zeo-Karb H.I. plant in conjunction with a standard "Permutit" sodium base-exchange softener, and it is no exaggeration to state that with the new equipment now available almost any type of water can be treated and rendered quite satisfactory for feeding to high- or low-pressure boilers. Plants are already in hand for treating the water to high-pressure boilers in power stations.

Mechanical Scale Removers

In cases where the installation of plant for chemical treatment of the feed-water before entering the boiler cannot be considered, we come back generally to

mechanical elimination of scale when its thickness is thought to be injurious to safe or economical operation of the boilers. In this direction "Skatoskal" and "Multiflex" devices for tube and surface scale are rendering good and reliable service. All types of plant are catered for, and the range of cleaning machines includes those with single drive direct from the motors, as well as multiple drives through the means of gear-boxes, and can deal with all types of tube or cylinder scaling, including water-tube boilers, economisers, water wall tubes, evaporators, condensers, superheaters, etc.

Superheaters

It is well known that the properties of superheated steam approximate to those of a perfect gas and that its thermal conductivity is lower than that of saturated steam. Higher efficiency and better operating conditions are a result of using superheated steam. There is always *some* loss of heat by radiation from steam pipes, and this loss represents an equivalent condensation when the pipe is charged with saturated steam. As superheated steam cannot condense (it must first be reduced to saturated steam by losing all its superheat), if sufficiently superheated it can lose the amount of heat represented by radiation from the steam pipes and reach an engine or turbine perfectly dry, which is highly desirable. With, for instance, a turbine of improved thermodynamic efficiency, due to a decrease in steam frictional losses, superheaters have proved themselves to be reliable, and some makers claim that the saving in fuel consumption by their use amounts to 1 per cent. for each 30° F. of superheat, which represents a considerable increase in the thermal efficiency of steam plant. Superheaters of suitable design for all types of boilers are available, and these, together with air heaters of suitable proportions, should be considered as necessary on both medium and large-sized plants.

Travelling Grate Stokers

There have not been any remarkable advances in travelling grate stokers. Standing out pre-eminently (in the writer's opinion) amongst this class of equipment for water-tube boilers is the Type "L" Underfeed Travelling Grate Stoker. The construction of the grate surface and the method of air distribution are of excellent design, and as it is non-riddling, very little deposit of dust is found in the air chamber, thus eliminating the necessity for any mechanical means for dust removal. A most important feature is that any part of the grate surface may be removed without shutting down the boiler and without disconnecting the tension chain. All boiler-house engineers know what a source of trouble burnt links in a chain grate can be, and the tremendous advantage provided by any travelling grate so designed as to enable grate bars or links to be changed when necessary, without stopping the boiler, must be seriously considered.

Amongst mechanical stokers which are putting up good performances, the Niagara Stoker fabricated by the Smokeless Combustion Co., Ltd., the Bennis Stokers, and the Robot Stoker have achieved wide popularity amongst users of Lancashire type boilers. Each of these possesses individual scoring points, and all are capable of securing high efficiencies, providing that they are maintained in good working order, which is not invariably the case.

Heat Insulation

The heat insulation of boilers and pipe-lines is, of course, an important matter, and in this direction it is necessary to state that a very full set of tests of various insulating materials has been carried out at Barton Power Station (one of the largest of the Grid Super-power Stations) by William Kenyon and Sons, Ltd., of Dukinfield, Cheshire. These tests are comprehensive, and as they were only concluded in February, 1939, having been in progress during the previous five months, they are of more than ordinary interest to works engineers who appreciate the heavy loss of heat from vessels carry-

A panel of instruments in a boiler house, showing CO_2 indicator, the reading being recorded on the left-hand instrument, together with the temperature of the flue gases. Pressure of steam is recorded on the central recorder. Right-hand recorder shows temperature at four different parts of building, outside temperature and relative humidity in building. Other temperatures such as steam, inlet and outlet of air heater, flue gases, etc., are indicated and read in turn.

(Elliott Brothers [London], Ltd.)

(*Continued on page* 18)

METALS
IN THE FOOD INDUSTRY

A SYMPOSIUM

ALUMINIUM AND ITS ALLOYS

ONE of the first causes of confusion into which the user of aluminium may easily fall is the fact that the pure metal and the alloys are frequently classed together under the loose generic term "aluminium", although the trade names, such as "Duralumin" and "Alpax", of certain alloys are now accepted as applying to essentially different materials. There is, however, no popularly recognised differentiation between aluminium and its alloys. Possibly in time to come, however, a single word will be coined to cover the many different kinds of aluminium alloys, and so distinguish them from the softer pure metal.

Pure Aluminium

Pure aluminium is soft and ductile, and while its strength and hardness can be increased by cold working, as in the case of pure iron, these properties cannot be improved by heat treatment. It possesses, however, many features which offset its moderate mechanical strength and which favour its use for a wide variety of applications. Low specific gravity is the most obvious of these properties, while, in addition, it can claim high thermal and electrical conductivity, excellent pressing, machining, welding and other working characteristics, and good heat and light reflectivity when polished.

Corrosion Resistance

The impression which still persists to a certain extent in the popular imagination that aluminium is inherently corrodible is quite incorrect, and that the basis for this belief rested in the past on the use of unsuitable alloys or of aluminium in which there were undesirable elements or inclusions.

Proof of the resistance of aluminium to corrosion is furnished by its wide use in chemical industries, where it is employed in the construction of containers and plant for the handling of acetic acid, synthetic ammonia, hydrogen peroxide and a host of other chemicals. In the processing and packing of foodstuffs like fish and margarine, aluminium is much used for its non-toxic and non-colouring properties, while most people are familiar with its use for caps and closures for bottles and jars containing sauces, cosmetics and similar products. "Silver" paper is almost invariably aluminium foil, and as a wrapping material it has no rival.

It was early recognised by producers that the low strength of pure aluminium constituted a very definite handicap to its complete development, and numerous alloying systems were introduced, the objects of which were to increase its strength without sacrificing to too great an extent its other favourable properties. Compromises have to be made, but with careful consideration suitable materials from the aluminium range may be selected for almost any purpose.

Three Groups

For simplicity the wrought materials may be divided into three groups:

(1) Pure aluminium, which can only be hardened by cold work.

(2) Alloys which contain constituents which do not confer susceptibility to heat treatment, but which are increased in strength according to the type and amount of the alloying elements, and which are capable of further variations in temper according to the amount of cold work. These are known as the "strain-hardened" alloys.

(3) Those containing elements which render the material susceptible to improvement in mechanical properties by correct heat treatment.

Taking these in order, pure aluminium has already been described, and it will have been noted that it has a definite but limited field of application.

Strain-Hardened Alloys

The second group, the strain-hardened alloys, have great commercial value, in view of the fact that strengths attainable are comparable with those of all but the strongest heat-treated alloys, while the expense and complication entailed in heat treatment do not occur. The principal alloys in this group are those containing 7 per cent. magnesium; 5 per cent. magnesium with $\frac{1}{2}$ per cent. manganese; $2\frac{1}{2}$ per cent. magnesium with $\frac{1}{4}$ per cent. chromium; $1\frac{1}{4}$ per cent. manganese with 1 per cent. magnesium; and $1\frac{1}{4}$ per cent. manganese. There is, in addition, an alloy containing 12 per cent. silicon, and others are also used which contain varying small percentages of magnesium, manganese, silicon and chromium. The corrosion resistance of all of these alloys is extremely good and generally is superior to the uncoated alloys of the heat-treated group.

Heat-Treated Alloys

The heat-treated alloys are in general more complex than the strain-hardened group; the best known is

One of the many types of Margarine Waggons made by A.P.V. Co.

"Duralumin", with about 4 per cent. copper and ½ per cent. each of manganese and magnesium. Other slightly stronger alloys have been developed from this by further additions of magnesium, manganese, silicon or nickel, or with small controlled additions of titanium, cerium or columbium. About 4 per cent. copper is, however, the basis of most of the wrought heat-treated alloys, and very few are without an appreciable copper content. In most of these alloys iron and silicon are present in quantities of less than 1 per cent., but these should not be regarded as impurities, since their inclusion is carefully controlled.

The functions of aluminium nowadays extend from the purely decorative to the very highly stressed, from balustrades or canopies to the pistons and connecting-rods of high-speed engines, from chocolate or cigarette wrappings to the buckets of huge excavators, and from the paint on lamp-posts to the propellers of aircraft.

STAINLESS STEEL

The term "stainless steel" does not apply to one steel only, but is a general term which embraces quite a number of steels of differing compositions, each with its own particular mechanical and physical properties, but all possessing, though in varying degree, the property of resistance to corrosion.

It is from the softer steels of the 18/8 class that the majority of food-processing plant is constructed. There are, of course, a number of different steels in this class, various other elements being added to the chromium and nickel for special purposes. Thus some of these steels contain certain percentages of titanium, whilst others have molybdenum added. The basic analysis, however, is generally 18 per cent. chromium and 8 per cent. nickel.

This type of stainless steel can be obtained in almost all forms, which is quite a valuable factor for the plant manufacturer and ultimately for the user. It can be rolled to all thicknesses, from heavy plates an inch or more thick if necessary for heavy plant, to less than five thousandths of an inch in thickness in the form of strip. A useful feature is that the steel in sheets and some other forms can be supplied with different types of finish; thus it can have a matt finish produced by pickling or it can have a smooth planished finish produced by cold rolling or it can be dull or bright-polished on one or both sides.

Joints

One of the most important problems which the plant and equipment maker has to tackle is that of making joints in a built-up structure. It has always to be borne in mind that any built-up job is only as good as its joints. The question of joints is particularly important in food plant, where surfaces must be clean and smooth and free from any irregularities which might harbour dirt or foreign matter, and thus adversely affect the product. Joints fulfilling these conditions can only be made by welding, and the weldability of the 18/8 stainless steel is excellent.

Advantages of Stainless Steel

The first and foremost advantage is, of course, the immunity of stainless steel to attack by the majority of food and food acids. Even this aspect, however, is only half the battle: the other half, of course, is the fact that stainless steel does not affect the food product. A feature which is of vital importance is freedom from metallic contamination. This may adversely affect the flavour, colour or keeping properties or even all three, and in addition it might, in certain cases, be detrimental to health. From the point of view of the life of the plant, such a small corrosion effect may be negligible, and therein lies the danger of using less resistant materials. It is therefore reassuring to know that not only is stainless steel unaffected by the majority of food acids, but also that the food itself is not contaminated by contact with the steel.

Stainless Steel Steam Pan of all-welded construction. (*Courtesy, A.P.V. Co.*)

The next important advantage is that stainless steel is the same throughout its mass. It does not rely for its properties upon a metallic coating or veneer, and there is therefore no possibility of the surface peeling or wearing away. If the surface of the stainless steel is scratched or damaged in any way, no harm is done so far as the intrinsic properties of the steel are concerned.

Cleanliness

The factor of cleanliness is, or should be, one of the foremost considerations in the maintenance of food plant. The ensuring of clean hygienic plant can form a very costly labour item in the budget of a food-processing concern. This charge is reduced to a minimum when stainless steel plant is used. The smooth, bright surfaces of such plant ensure freedom from lodgment of the product or of foreign matter, and make cleansing a relatively simple and speedy operation. Besides the resistance which stainless steel possesses against corrosive attack by food and food acids, it has another very valuable property—that of being completely resistant to alkalies and alkaline cleansers.

Having briefly considered the hygienic advantages of stainless steel, I would like to direct your attention to a few of the more important applications of the steel in the food industry.

Milk

Probably one of the largest items of food, and certainly one of great importance, is milk and its associated products. Practically all the milk which is produced is handled in metal equipment at some time in its passage from the cow to the consumer, and it is, therefore, important from the viewpoint of general health that the best possible equipment be used. I think I can truthfully say that among all the food industries, the dairy and allied industries are the biggest users of stainless steel equipment.

Another process which is making extensive use of these special steels is that for producing milk powder. Two of the biggest plants in the country have been constructed throughout in stainless steel.

Cream, butter, cheese, ice-cream, etc., are other products in the making of which stainless steel plant is used. Stainless steel is quickly becoming a standard material for containers in conservators, mixing and ageing vessels in connection with the manufacture of ice-cream.

Other Foods

Brief reference only can be made to the great number of other food products. Many of these, such as potted meats, preserves, etc., call for boiling pans. These are usually of the steam-jacketed type, and considerable use is being made of stainless steel for this type of equipment.

Mixing machinery for bread and confectionery is another avenue which stainless steel has entered, whilst use is being made of it in connection with patent cereals.

Increasing use is being made of these special steels for abattoir equipment, such as rails, hooks, chutes and tables.

There is ample evidence that the food industries of this country are making increasing use of the special steels which the steelmaker has to offer, and there is no doubt that each step taken represents a further advance in the safeguarding of the nation's health.

TIN

The safety of tin in contact with foods has been recognised for centuries, as is shown by the brightly tinned copper saucepans of Roman origin which are still to be seen in the British Museum. Tinned copper, brass and iron have been used ever since for preparing food both in the home and on the manufacturing scale, and the metal has acquired a reputation that makes the use of the terms "block tin" or "heavily tinned" a generally accepted recommendation of hardware.

Antiquity of Tin

Curiously enough, the very antiquity of its reputation is by way of being something of a disadvantage in an age which has seen so much successful novelty that it is almost convinced that novelty is essential to success. It is natural that designers and users of food apparatus and equipment should turn eagerly to new metals and plastics in the hope that the troubles they have with older materials may be avoided. This has little novelty about it and three very obvious limitations—namely, a low structural strength, a low melting point and a fairly high cost. As a result, apart from a few special uses, such as for cooling coils in acid liquors or beer, the metal can seldom be used alone, but finds its main outlet as a lining or coating for cheaper and stouter metals that require protection.

In recent years it has become generally appreciated that the ability of a sample of metal to withstand under laboratory conditions the corrosive action of a liquor is no criterion as to how large-scale equipment built of that metal will behave under practical conditions. Many of the most troublesome cases of corrosion occur with only mildly corrosive solutions when they are in contact with more than one metal and galvanic action is set up. The important thing is to have the liquor in contact with the same metal throughout, in vats, pipes, cooling coils, and valves. The most convenient method, and it is also the cheapest, is to make the equipment in the constructional materials best suited to the job and then to tin them all so that all the interior surfaces liable to come in contact with the liquor are coated with the same metal.

Tinning Methods

The traditional method of applying the tin is by hot-dipping. The parts are cleaned in a dilute acid pickle, dipped in flux for a moment and then immersed in a bath of molten tin. After being swirled and turned, the articles are removed, held above the bath for a few seconds to drain, and then allowed to cool. Most tinners give the articles a dip in a second finishing bath. Large pieces of equipment which cannot be immersed in the bath are coated by "wiping" the tin on the fluxed surface, using a blowlamp to heat the surface so that it becomes tinned. It requires considerable skill to produce the beautiful lustrous coatings of the professional tinners, and this work is best left to them.

In the last year or two methods of applying tin coatings by electrodeposition have become a commercial proposition. The article is suspended as a cathode in either an alkaline or an acid tin-plating bath in close proximity to an anode made of block tin which dissolves and deposits itself in a remarkably uniform plating on the article. Thanks to both types of bath possessing excellent throwing power, no difficulty is experienced in depositing an adequate thickness in recesses and inside pipes. Where the article is too big to be immersed in a bath the plating solution may be poured into it and the tin anodes suspended in the solution. The article is then made the cathode and tin deposits itself in it.

Spraying Molten Tin

Another method that has been used a good deal in the last few years is spraying molten tin on to the article, using a spray gun in which the tin is melted by a flame of oxygen-coal gas or compressed air and hydrogen. The molten particles of tin are blown out of the nozzle, and, impinging on the metal article, become flattened into innumerable overlapping discs more or less fused together. The article does not become very hot during the process; and as, furthermore, the spray gun can be used inside large equipment without dismantling it, this method is often particularly valuable in repair work, and remarkably good wearing qualities have been obtained with sprayed coatings.

Tin-coated equipment is extremely resistant to the majority of food materials, and its life is dependent chiefly upon the care taken in cleaning. Abrasives and metal brushes, of course, scratch and wear away soft tin coatings, so their use should be avoided. Apart from this the principal cause of damage is oxidation by the air present in cleansing solutions. The life of the tin coating may be preserved by using the cleansing solutions very hot, since they then contain the least amount of air, but the most effective remedy is to use a cleanser containing some sodium sulphite, which removes any free oxygen from the water in the cleansing solution and forms with it Glauber's salt which is harmless alike to the tin coating and to living creatures. A number of proprietary cleansers for dairy equipment contain a

carefully balanced addition of this salt, and their use has been found to prolong the life of the tin coatings many times over.

COPPER

Copper has a number of desirable properties which commend its use for the manufacture of plant for food processing. Among these properties are its high strength, which is maintained at moderately high temperatures; its high ductility in the annealed state, which enables it to be readily worked to any shape required and facilitates alteration and repair; its ease of joining, by such methods as welding, brazing, soldering; and its very high thermal conductivity, second only to silver. The excellent resistance to corrosion displayed by copper and its alloys is another factor which has led to its wide use for food-processing plant. It is also the cheapest of the non-ferrous metals used for food equipment and it has a high scrap value.

Deoxidised Copper

The type of copper generally employed for the manufacture of plant is deoxidised copper. This variety has come into general use for plant during the last decade or so owing to the fact that it can be successfully welded. The small amount of oxygen (amounting to 0·02 to 0·08 per cent.) present in the tough pitch copper formerly used is sufficient to cause difficulty during welding owing to the interaction between the reducing gases of the oxy-acetylene flame and the oxygen, the steam so formed causing unsoundness in the weld and adjacent metal with consequent loss of strength. With deoxidised material the steam reaction is avoided and, if properly made, the weld should be as strong as the parent metal. An autogenous welded joint is the most satisfactory when corrosive liquids are to be processed, and is the method generally employed for joining sheets. If corrosion is not anticipated, sheets may be bronze welded, brazed or silver soldered, and the same methods are in general use for joints in piping carrying process liquids, water or steam. Mechanical joints of the compression type are also used owing to their ease of assembly and the rapidity with which the joint can be broken and re-assembled when required.

Physical Properties

The following figures represent average values for some of the more important physical and mechanical properties of copper:

Thermal Conductivity: 0·92 *Cal. per cm.*^{2} *per cm. per sec. per* °*C.*
Coefficient of Thermal Expansion: 0·000016.
Specific Heat: 0·092.
Tensile Strength: 14-15 *tons per sq. in.* (*annealed*).
20-26 *tons per sq. in.* (*cold worked*).
Elongation: 50-60 *per cent. on* 2 *in.* (*annealed*).
5-20 *per cent. on* 2 *in.* (*cold worked*).

A wide range of copper alloys exist which can be used if a strength or hardness greater than that of copper is required. Among these alloys may be mentioned those of copper with tin, nickel, aluminium, silicon and zinc. The copper-zinc alloys, or brasses, are of the greatest importance for general engineering work, and therefore widely used for the auxiliary plant and equipment, though not greatly in demand for those parts actually in contact with foods during manufacturing owing to their lower corrosion resistance. The tin bronzes are quite frequently used for making autoclaves, and the copper-tin-zinc alloys, or gunmetals, in common with many other alloys, are extensively used for pumps, valves, stirring gear and other fittings. Apart from the brasses, there is, generally speaking, little difference in corrosion resistance between copper and the copper alloys in use.

Uses in Food Industry

Copper is very extensively used for manufacturing processes involving boiling of sugar solutions and fruit juices. In the refining of the sugar, and the concentration of glucose solutions, copper evaporators are used, while in the preserve and confectionery trades copper boiling pans are commonly used. In the latter operations the high thermal conductivity and low specific heat of copper enable the boiling operation to be completed in the shortest possible time, with consequent maximum throughput and minimum loss of flavour. If delicate flavours are involved, vacuum-pans are used, which are also made of copper. Stirring gear is usually made of bronze or gunmetal.

In contact with some foodstuffs, very small quantities of copper may go into solution and cause or accelerate the development of undesirable flavours. In such cases the use of tinned copper is widely adopted, as by this means the ease and economy of fabrication in copper is maintained, while the tin coating prevents any contamination of the foodstuff. Tinned copper is used in the milk industry for such purposes as piping, pasteurising and refrigerators. In the manufacture of condensed and dried milk, the copper evaporators are often untinned, as under these conditions the copper does not have any deleterious action on the product. Tinned copper pans for general household and restaurant cooking have been used for centuries, and at the present time are in common use in hotels and ships where their robustness is a great advantage.

Copper equipment (which may be tinned) is used in almost every case where evaporation of solutions is required in the manufacture of extracts of all kinds.

Silver-lined copper plant is sometimes used more particularly in contact with acetic acid and vinegar if a very pure product is required. The silver coating is generally applied as a sheet lining, though in some instances an electrodeposit of silver may give satisfaction.

MONEL METAL AND NICKEL

Although both Monel Metal and nickel are used for a wide variety of purposes their advantages are conspicuously apparent in the wide range of established uses in the food production and canning industries.

The operations in most food processing plants fall naturally into divisions, such as separating and grading, grinding, straining, cooking, etc. The equipment used for each process varies considerably according to the character of the product handled.

Sorting, Separating and Grading

Simple sorting operations are frequently carried out on tables. Various types of tables are used, some being fitted with pans and belt conveyors, but in the majority of cases ordinary flat-topped tables are employed.

Monel Metal is widely used for this type of equipment. It is also used for screens and perforated drums in various types of separating equipment.

Owing to its great resistance to the corrosive action of brines, it is extensively employed for grading machines which depend upon using brines for the operation.

Washing and Brining

The properties which make Monel Metal suitable for this service are resistance to the attacks of abrasions

and of corrosive materials. Among the various types of washers which have been made from this metal are the rotary screen, horizontal table, and tank and basket types.

Monel Metal washers are employed for cleansing spinach and asparagus, where it is necessary to use materials which will withstand abrasive action of sand and grit. Jars, bottles and other containers are also washed in Monel Metal equipment. Most of these washers are power-driven machines, in which it is necessary to use alkaline and chlorine sterilising solutions.

In canneries Monel Metal tanks are replacing wooden ones for the brining of peas. Heating coils for these tanks are likewise made of Monel Metal.

Conveying

Within recent years great progress has been made in the design and operating efficiency of the various conveying systems used in modern plants. Monel Metal possesses a combination of physical and chemical properties particularly suitable for the construction of equipment of this character: hence its use in almost every type of conveyor. For general conveying, spirally woven mesh is commonly used; other conveyor belts are made from strip or sheet. In meat-packing plants Monel Metal has been adopted for conveyor pans and tables.

Drying, Blanching and Scalding

The conditions met with in drying operations vary from mildly corrosive to strongly corrosive and from lightly abrasive to heavily abrasive, or combinations of both may be encountered. Rotary drums, shelf dryers, jacketed drums, vacuum dryers, centrifugals and spray, compartment, tubular and agitator dryers are all employed.

Because of its resistance to the corrosive inflence of steam, moisture and the juices of the products handled, Monel Metal finds many applications from the large rotary blanchers to the simple crate or dipping basket used for scalding operations.

Mixing

Mixing may be carried out under high positive pressure or in a vacuum, and liquids, pastes or solids may all be treated. Monel Metal has been widely adopted for mixing equipment on account of its great strength and resistance to corrosion. Portable mixers for clamping on to tanks are usually fitted with Monel Metal shafts and propellers. This type of equipment has been successfully used for many years in the processing of numerous corrosive products.

Filtering, Clarifying and Straining

Monel Metal is widely employed for filter cloth in simple gravity filters. It is also employed in many types of rotary and continuous filters, and frequently the whole of the filter drum and tank are made from the metal.

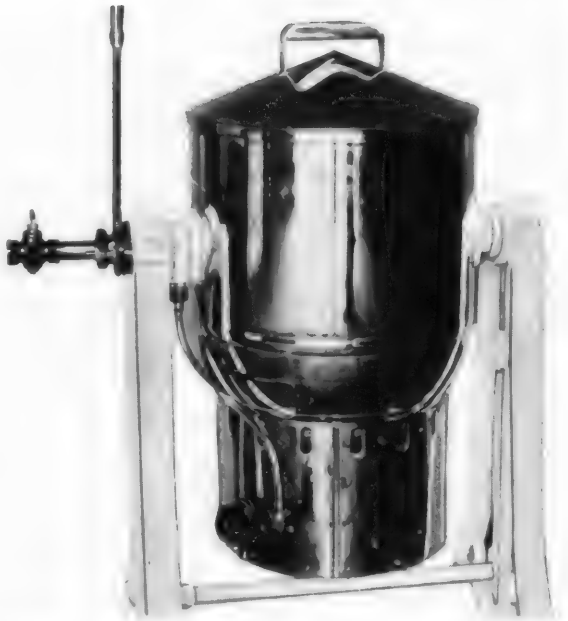
Both Monel Metal and nickel filter cloth are standard products of regular wire cloth manufacturers.

Where centrifugal extractors are employed, Monel Metal is frequently used for baskets, wire cloth liners and bowls. For bowls used with high-speed centrifuges, tensile strength is an important requirement. Monel Metal bowls of this type are extensively used in the clarifying of fruit juices, syrups, etc.

Filters using a system of edge filtration and employing a series of thin Monel Metal discs are also employed.

Cooking Kettles

Steam-jacketed and plain kettles are used for cooking operations in most food-product factories. This is a type of service for which Monel Metal and nickel are pre-eminently suitable, and in numerous plants difficulties encountered in the cooking of foodstuffs have been eliminated by the adoption of these materials.



Ten-gallon tipping pan with gas jet firing and swivelling gas pipe connection.

(Courtesy, Morton Machine Co., Ltd.)

Widely diversified products, such as soups, chickens, puddings, dates, chutney, cherries, cranberries, pineapple and other fruits, syrups, macaroni, jams, marmalade and jellies, tomato products, sauces and legumes, are handled in nickel equipment.

The ease with which Monel Metal and pure nickel can be coiled and the ready availability of the necessary nickel fittings has resulted in many manufacturers adopting them for equipment requiring strength, durability and cleanliness.

Such coils, because of their clean, smooth surface and freedom from corrosion, have a high rate of heat transfer. They are now used in contact with syrups, brines, fruit juices, milk, soups, tomato products, jams and jellies, clam broth and beverages.

Filling and Packaging

Monel Metal is employed for various components of filling and packaging machines, particularly those which come in actual contact with the product. Resistance to corrosion is important in most cases, for brine, vinegar, fruit and vegetable acids and similar corroding media may be present. High strength is also necessary, for parts of filling machinery are often subjected to hard usage.

Typical components of filling machines made from Monel Metal include hoppers, chutes, slides, cylinders and plungers, springs, valve parts, tubes, feeding mechanisms, bolts, nuts, studs, drip pans, and plates, etc. In some cases pure nickel is employed.

Fruit Juice Processing

The widespread use of Monel Metal equipment in fruit juice factories is due to the fact that it is not harmfully affected by citric, malic or other fruit acids. Monel Metal is employed for components of slicing and cutting machines, table tops, hoppers, sinks, pans, conveyors, pipe lines, heating coils, extraction burrs, clarification apparatus and filter cloth.

Pure nickel is widely employed in this industry for stills and dispensing equipment.

Fish-Packing Equipment

The resistance of Monel Metal to abrasion combined with its immunity to the corrosive action of salt and fresh water make it an exceptionally suitable material to use for fish-packing equipment. Hoppers, storage bins and measuring utensils are all made from the metal.

In quick-freezing systems, Monel Metal equipment, including filleting machines, cutting tables, decapitating machinery, brining equipment and filling machines, is employed on an extensive scale.

ZINC

The uses of zinc in the food industry are numerous, but for the purpose of this short review the use of the metal in one form only will be discussed—that is, in sheet form.

Zinc coatings have not yet found extensive use in the food industry. Galvanised sheet with a heat-treated surface is, however, used for refrigerators. The specially treated surface is enamelled.

Zinc Alloys

Zinc alloys are becoming more used, especially in connection with small manufacturing machines and food utensils such as potato peelers, egg beaters, etc., that are in more common use in American homes than in this country. This enables such articles to be mass-produced at a greatly reduced cost. Although the use of these alloys is not very extensive in the food industry at the present time, modern developments are increasing their use, and they are likely to be much more popular in the future.

Sheet zinc is used in a number of forms in the food industry, but before discussing these various uses it is well to note the standard sizes of the sheet used in this country. These are 7 ft. by 3 ft. and 8 ft. by 3 ft. When using sheet zinc it is advisable to use it in these standard sizes and to avoid cutting as much as possible.

Zinc is rolled to the Zinc Gauge, which rises in number with thickness, and should not be confused with the Imperial Standard Wire Gauge. The table on the right explains the Zinc Gauge:

Lining Material

One of the most extensive uses of zinc in the food industry is for lining bins used for storing grain, flour, and other foodstuffs. The metal has special properties which make it particularly suitable for this purpose. It is impervious to attack by rodents, which cannot gnaw through the metal. Small insects have great difficulty in scaling the surface of the zinc. This property is due to the rolled zinc having a very smooth surface, on which insects find it very difficult to obtain a foothold. The surface of the metal usually feels slightly greasy.

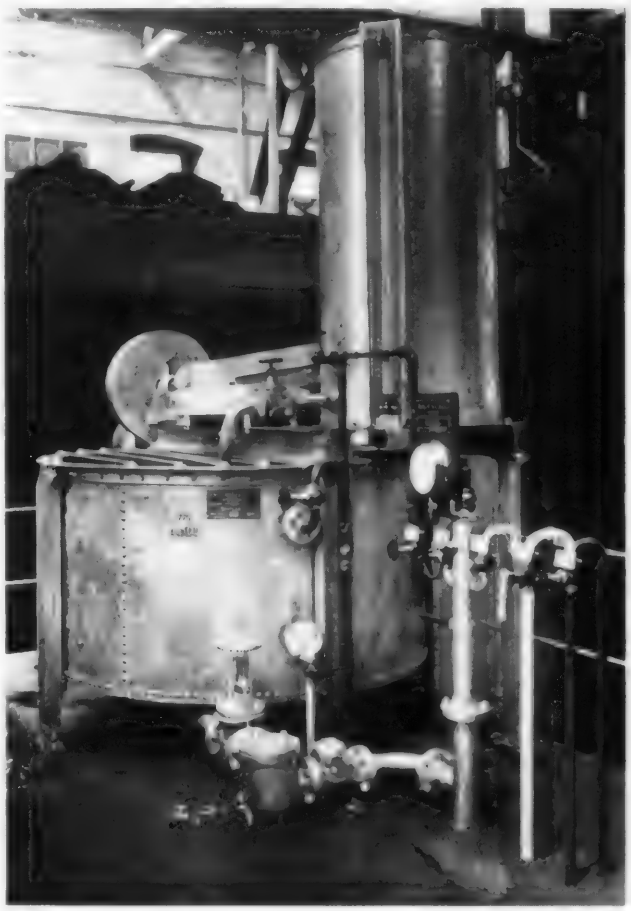
In countries which are liable to locust plagues, zinc has always had an extensive use due to this property. The field in which the locusts have descended is surrounded by a fence of zinc sheets, and a trench is dug just inside this fence. The trench is filled with paraffin, or some other inflammable substance, and set on fire. Any locusts that are able to cross the fire barrier find it impossible to scale the fence and slip back into the trench and are burned.

Table showing the Weights of Various Gauges of Zinc Sheets

Based on 1 square foot × 1 in. thick = 37·456 lbs. (Sp. Gr. 7·2).

Zinc Gauge No.	Approx. Weights per sq. ft. in ozs.	Thickness in decimals of an inch.	Approximate Weight per Sheet.	Approximate No. of Sheets in 1 cwt.	Approximate Weight per Sheet.	Approximate No. of Sheets in 1 cwt.	Nearest Imperial Standard Wire Gauge.
			lbs. ozs.		lbs. ozs.		
1	·74	·0025					42
	·96	·0033					
	1·92	·0065					37
4	3·70	·0125	6 5	350	7 3	304	35
5	5·60	·0190	7 14	278	9 0	240	32
6	7·39	·0251	9 10	220	9 14	227	30
7	7·79	·0265	10 4	210	11 11	190	29
8	8·09	·0275	11 1	199	13 0	169	28
9	10·19	·0347	13 6	168	15 5	147	27
10	11·49	·0391	14 15	149	17 1	131	25
11	13·18	·0449	17 5	129	19 10	114	24
12	14·98	·0510	19 11	114	22 8	100	23
13	16·78	·0571	22 —	102	25 3	89	22
14	18·58	·0632	24 6	92	27 14	80	21
15	21·57	·0734	28 5	79	32 5	70	20
16	24·57	·0841	32 4	69	37 14	61	19
17	27·57	·0940	36 —	62	41 7	54	18
18	30·56	·1051	40 —	56	45 14	49	
19	34·16	·1167	44 14	50	51 4	44	17
20	37·76	·1284	49 9	45	56 10	40	16
21	41·36	·1370	53 1	41	62 1	36	15

Sheets thicker than No. 21 Z.G. are rolled to the Imperial Standard Wire Gauge, which differs by fractions of an inch.



Sugar melting and mixing tank, with the water calibrating tank above it.

(Robert Kellie and Sons, Ltd.)

(*Continued on page 16*)

HYDROGEN SWELLS

Specially Contributed

Hydrogen swells have been, with certain types of fruit, one of the major problems of fruit canning. As the author points out, the alleviation of the trouble lies in the hands of both the can maker and the canner, and a radical cure is suggested.

ONE OF the most important single problems confronting the canning industry is the prevention of spoilage due to hydrogen swells. This problem has been engaging the attention of research chemists for many years, and some tangible progress has now been made towards its solution. It is the purpose of this article to give a brief review of this work to date, of the results which have been achieved, and to suggest practical means whereby canners may reduce or even eliminate hydrogen swells.

Acid Attack on Tinplate

Hydrogen swells are caused by acid attack on the metals of which the can is made, and occur mainly in canned fruits. The metals dissolve in the acid syrup derived from the fruit, and a corresponding amount of hydrogen is evolved. This hydrogen collects in the headspace, causing the vacuum originally there to be reduced to zero, and finally building up a pressure which bulges out first one and then both ends of the can, rendering it unsaleable. Canned fruit varies considerably in its shelf life, some varieties forming swells after perhaps nine months' storage while others last perfectly for two years or more.

It might be thought that the syrup containing most acid would be most prone to hydrogen swells. This is not so; all fruits contain acid in varying amounts, but there is no correlation between the corrosive powers of a fruit and the amount of acid it contains. It is now known that the intensity of attack on a metal by an acid does not depend on the concentration of acid as such, but on the concentration of free "hydrogen ions" to which it gives rise. The hydrogen ion concentration in solutions of weak acids such as occur in fruit syrups is very small, and to avoid the inconvenience of thinking of and referring to minute quantities, effective acidity is now expressed by the well-known *p*H scale, on which the acidity of a 3·65 per cent. solution of hydrochloric acid has a *p*H value of 0 while pure water has a *p*H value of 7. On this scale of two solutions whose *p*H values differ by unity, the one with the lower value is ten times as strong in hydrogen ions as the other. The *p*H values of fruit syrups range from about 3 to 5 *i.e.*, their proportions of hydrogen ions and their effective acidity range from one-thousandth to one-hundred thousandth of that in "normal" (3·65 per cent.) hydrochloric acid.

Effects of Acid Addition

If attack on the metal of cans were to depend, as would be expected, on effective acidity, then syrups of low *p*H would be more corrosive than those with higher *p*H values. Experience has, however, shown that in general the reverse is true, and it has in fact been found that for certain fruits corrosive action is diminished by adding acid to the syrups. For instance, if citric acid (the acid most commonly found in fruits) is added to packs of white cherries or prunes, a longer shelf life is obtained. This is, however, not a general result, and when acid has been added to other fruits it has been found that the failures are as numerous as the successes. The beneficial effects of adding acid to white cherries can only be explained as some effect peculiar to that fruit and unconnected with *p*H. Evidently in order to understand the causes of and factors influencing hydrogen swells it is necessary to enquire more closely into the corrosion processes occurring in the can.

Mechanism of Corrosion

The actual dissolution of a metal in an acid with the evolution of hydrogen does not take place as a single reaction over the whole of the metal surface, but the two processes are separated. At certain spots the metal dissolves and at others hydrogen gas is formed, and it is found that the spots where metal is dissolving are electronegative with respect to those where hydrogen is evolved *i.e.*, a potential difference is set up and a current flows

A sound can and a hydrogen swell.

through the metal from positive to negative areas and back through the acid solution. If instead of one such metal there are two immersed in acid and connected together, one metal will be electro-negative to the other, and will dissolve, with the evolution of a corresponding amount of hydrogen at the surface of the other metal. This action will go on simultaneously with that which would take place if the two metals were separated, with the result that the dissolution of the more negative metal will be accelerated and that of the more positive metal will be retarded. Now tinplate always contains holes or pores in the tin coating where the steel baseplate is exposed, so that in a plain can packed with fruit there exists at each pore a minute electric battery with the tin dissolving and hydrogen being evolved at the steel surface. But there is also another effect which comes into play. The current flowing in the local battery is controlled by the voltage, which at the first contact between acid syrup and tin may be considerable. With the first passage of current, however, the metal surfaces are instantaneously changed and the nature of the solution in contact with them is altered in such a way as to diminish the effective voltage, and in consequence the current falls until a steady state is reached with a small steady current flowing. This effect of the current in reducing voltage is termed polarisation and the amount of polarisation occurring is influenced by various substances present in the syrup. The amount of hydrogen evolved is proportional to the current flowing, and those substances which cause the voltage to drop so that the current is small allow only a slow evolution of hydrogen to take place—in fact, they are inhibitors of corrosion, while substances which have the opposite effect are accelerators of corrosion and promoters of hydrogen swells.

Measurement of Corrosive Power

On the basis of the mechanism of corrosion given above it has been possible to suggest a method whereby the corrosive powers of a canned fruit may be measured and hence its shelf life predicted. Furthermore, some idea can be gained of what classes of substances are likely to be accelerators or inhibitors of corrosion, thus making their isolation and identification easier, and suggesting new substances which can be used as inhibitors. Much remains to be done in this field, but it has been very firmly established that sulphur dioxide in a fruit syrup is a strong accelerator of corrosion, even when only a few parts per million are present. Sulphur dioxide and possibly other corrosion-promoting sulphur compounds in a syrup may be derived from the sugar, from spray residues on the fruit, and possibly from colouring matters. It is unfortunately impossible to manufacture sugar which is guaranteed free from sulphur dioxide, but unblued sugar is less likely to contain it. Before the war began arrangements had been made by which sugar manufacturers would test each batch of sugar and set aside for canners those containing negligible amounts of sulphur dioxide. Fruit contaminated from sulphur sprays is hard to eliminate, but most growers are now aware of the dangers of using such sprays after the fruit has started to form, or of spraying adjacent trees of a later variety from whence the spray may be carried by the wind.

Top: Side seam of an unused can.
Bottom: Side seam of a "flush lacquered" can of plums after 12 months, storage. Very little difference can be observed.

An important accelerator of corrosion is the natural colouring matter of the fruit, and the effect of ripeness on hydrogen swells is now under investigation. As regards inhibitors nothing satisfactory has been discovered. Gelatine, agar, pectin and other substances have been suggested and tried, but their beneficial effects are slight and uncertain. Beet sugar sometimes contains an inhibitor and it may on this account be preferable to cane sugar.

The Canner's Part

It is in the canning factory itself that most can be done towards minimising hydrogen swells. One of the most important operations from this point of view is the exhausting process. Cans are given a preliminary heat treatment or exhaust before seaming on the top end, with the twofold object of driving out air from the fruit and of heating and partly replacing with water-vapour the air in the free space at the top of the can. When a preheated can is seamed and eventually cooled, the heated air contracts and the water-vapour condenses, creating a partial vacuum inside the can. The higher the vacuum the longer it takes for the evolved hydrogen to reduce it, and to build up a pressure sufficient to bulge out the ends of the can. The hotter the contents of the can are just before seaming the better the vacuum, and it is advisable, for this reason, that the exhausting treatment should be as thorough as possible. A second important factor is the size of the free space at the top of the can. The larger the space between the surface of the contents and the underside of the top end, the longer it takes for the can to become a hydrogen swell. On the other hand, the space must not be too large or complaints of under-filling will result. A suitable distance is a quarter-inch between the top of the contents and the end.

Thirdly, the formation of hydrogen swells is affected by the temperature of storage. Cans are cooled in water

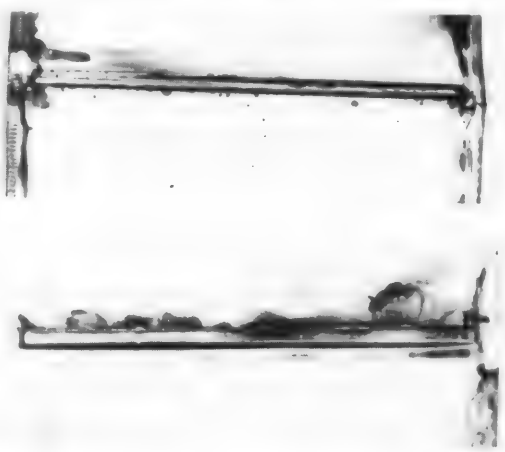
after the cooking process, and it is customary to remove them before they are quite cool in order that the water may dry off them quickly. If they are packed into cases and these are built up into stacks while the cans are still warm, it is certain that the cans in the middle of the stacks will take many weeks to cool down. At a temperature of 95° F. a can becomes a hydrogen swell very much more rapidly than it does at ordinary temperatures of 65° F., so that the cans in a stack at a temperature of about 95° F. for a month are actually several months nearer becoming hydrogen swells than if they had been stored under cooler conditions.

The Can Maker's Task

Finally, what is the can maker able to do towards preventing hydrogen swells? It has already been stated that all tinplate has pores in the tin coating—*i.e.*, numerous minute patches where the steel baseplate shows through—and it may be years before tinplate is made free from pores, if indeed this ever becomes possible at all. Since the steel is exposed, the composition of the steel baseplate is a factor influencing hydrogen swells, and intensive research work has been carried on for many years on the subject both in this country and in the United States. The recently introduced process of "cold reduction" has been found particularly beneficial, largely because steel rolled by this method can, and indeed must, be of such a composition as to give high resistance to chemical attack.

The Remedy—a Complete Can Lining

The best method and the one that is likely to supersede all others, which are only palliatives, is a complete inert covering on the inside of the can. Cans for red fruits like strawberries or red plums are now supplied with an internal covering of lacquer, the purpose of which is to preserve the colour of the fruit. Existing lacquered cans are just as susceptible to hydrogen swells as plain cans, because the lacquer is applied before the can is made up, and the manufacturing processes must necessarily damage the layer of lacquer, particularly near the side seam, exposing approximately equal areas of tin and steel to the attack of fruit acids. The attack being concentrated on a small area of tin soon dissolves it, and hydrogen is evolved just as rapidly from the area of steel exposed as it would be from the tinplate of a plain can. Several methods have been tried for lacquering the can after it is made up, thus eliminating breaks in the lacquer coating due to the manufacturing processes, and one is now in commercial operation, producing a can with an almost perfect lacquer coating. These "flush lacquered" cans have been available to canners for the first time on a large scale this year. They will give a shelf life two to three times as long as that obtained with ordinary cans, and their contents should thus be sold and consumed long before the cans become hydrogen swells.



Side seams of standard lacquered cans of plums which had become hydrogen swells after 12 months' storage.

Metals in the Food Industry

(*Continued from page* 13)

Sheet zinc, when used for lining storage bins, etc., is joined in the same manner as other sheet metals—that is, by welded joints or by soldering. If the substance which is being stored is rather fine, it is advisable to have a soldered joint, and the most suitable composition of solder for use on zinc sheets is 60/40 Tin/Lead, containing no antimony.

Sheet zinc is also used in large quantities for lining food containers used on railways, especially in tropical countries, and in conjunction with these, perforated sheet zinc grills and ventilators are frequently used. Perforated zinc is obtainable in a large range of perforations, and in various thicknesses of sheet.

Jar and Bottle Caps

In America one of the most important uses of sheet zinc in the food industry is for the manufacture of jar and bottle caps. These zinc caps are pressed out of sheet zinc, and the upper portion of the cap contains a moulded glass disc. A rubber ring is then fitted into this cap, and it is screwed on to the jar. The jars are generally obtainable in pint and quart sizes, and the rubber ring which forms the seal is obtainable at any store.

In America these jars are commonly referred to as "Mason" jars, and to housewives all over the country, particularly those in the rural districts, are an essential part of kitchen equipment.

ACKNOWLEDGMENTS

Aluminium and its Alloys :

Aluminium Information Bureau.

Stainless Steel :

Abstract from a paper read by C. Cyril Hall before the Royal Sanitary Institute.

Tin :

International Tin Research and Development Council.

Copper :

Copper Development Association.

Monel Metal and Nickel :

Bureau of Information on Nickel.

Zinc :

Zinc Development Association.

PROFESSOR J. C. DRUMMOND

REVIEWS

CANNED FOODS IN RELATION TO HEALTH—a special article written for *The Lancet* by SIR WILLIAM SAVAGE.

HALF THREE-SCORE YEARS AND TEN

"THIS IS DEFINITELY my experience of over thirty-five years' continuous study of these food poisoning outbreaks." So reads a pregnant sentence of Sir William Savage's outstanding review of the present position of canned foods in relation to health which appeared in a recent issue of *The Lancet*.* What a period his experience covers! I wonder how many people realise that it was as recently as 1908 that the forerunners of the Ministry of Health, the Local Government Board, drew attention to an "improved system" which a progressive London factory had introduced only a year or two before for controlling the quality, particularly the keeping quality, of canned foods. The "improved system" was a novelty, at all events so far as this country was concerned, and it consisted of nothing more than the institution of a certain amount of bacteriological control, which by modern standards would appear primitive to a degree.

The Beginning

The opening of the twentieth century really marked the beginning of the canned food industry as we know it to-day. There was, it is true, a century of history since the little factory in Blue Anchor Road, Bermondsey, had turned out the first hand-made canisters of heavily tinned wrought iron packed with "Corned round of beef", but most of that were best forgotten. It had started well. Donkin and Hall's "Preserved Provisions" earned an enviable reputation before Waterloo was fought, but the industry was born before its time. Science had little or nothing to offer in guiding its early years. Ignorance of the simple fact that heating is more important than expulsion of air brought disaster when enterprising manufacturers tried to prepare much larger packs than the pioneers had turned out. The public began to hear disturbing tales of the masses of putridity found when cans of meat were opened. A rising tide of scandal so alarmed the Admiralty that in 1850 a Select Committee of Enquiry sat. The Minutes of the Evidence, published two years later, profoundly shocked the public, and to justifiable fear the wildest rumours added unreasonable alarm. What a legacy of distrust and suspicion those few years left with us! Its influence can be traced for at least the remainder of the century, and I am certain Sir William Savage met many experts in the early days of his long experience who firmly believed that there was something about the canning process that made food, meats in particular, especially liable to decompose and develop the "ptomaines" which were at that time a popular bogy.

* November 4, 1939, p. 991.

Early Vitamin Research

Nor was that all. I can myself remember the early days of vitamin research—days when the general idea of these dietary constituents was that they were ill-defined bodies such as the enzymes, and when even those of us who thought that they would prove to be clear-cut chemical compounds suspected that they were readily destroyed by heat. It is not surprising that the view soon gained ground that canned foods had lost their vitamins during manufacture. From this it was a short step to the belief that they had lost their vital principle; were, in fact, "devitalised".

Half a human span of years has passed since the experiences of the last Boer War brought the fortunes of the canned food industries to a critical turning-point. Except for very minor checks, they have since led from success to success.

What does expert judgment say at the end of those years?

"As regards our food supply generally, canned foods can be accepted as a safe and convenient source and one without any special hazard, nutritional, chemical or bacterial." I hope the history will be written one day of the enterprise, the effort, the perseverance, the resourcefulness and the courage that have made such a verdict possible.

Canned Food Not Devitalised

It is to be hoped that Sir William Savage's timely survey will dispel the last traces of the distrust of canned food. It should do so because the evidence he reviews is strikingly convincing. Loose talk about "devitalised foods" will make less and less impression as the knowledge spreads that man can live in perfect health month after month on a diet almost completely composed of canned foods. To a scientist the experiments of Kohman and his colleagues in the United States, and more recently those of Godden and Thomson working in the Rowett Research Institution, are convincing; but to the layman who may think, quite reasonably, that the rat and himself are two very different creatures, it means a great deal that a scientific expedition to Greenland lived in excellent health for over a year on food out of tins. So we can banish the bogy of "devitalisation". But can we as easily reassure those who still fear the evil menace of "food poisoning"? Thirty years of misapplied terminology has implanted the word "ptomaine" firmly in the British mind. Just as every individual who has a rather bad catarrhal cold insists firmly that it is 'flu, and expects appropriate sympathy, so an average person

who has eaten with indiscretion and is suffering consequences richly deserved assures one that he has been attacked by "ptomaine poisoning". The next step, of course, is to blame oysters or lobster or alternatively "something out of a tin".

The True Perspective

Sir William Savage puts the whole matter into its real perspective. Tinned food, like all other foods, may be the vehicle for food poisoning, but true food poisoning arising from tinned foods is, in sober fact, comparatively a rare disorder. It may be caused either by the survival and growth in the food, after processing, of heat-resistant organisms which produce toxins able to cause trouble in the human body or by toxins produced in the food by bacteria before the contents of the can are sterilised. In this type the toxins are still harmful after heating, although the bacteria are dead.

Cases of the first type exemplified by botulism are noteworthy for a grim record of fatalities, but of the three or four outbreaks recorded in this country not one was traced to tinned foods. The milder outbreaks of the toxin type still occur, but modern methods of manufacture have considerably reduced their incidence which, bulk for bulk, is less than that for other foods. The conclusions from the study of all the data are that tinned foods are considerably less liable than others to be a source of food poisoning.

Sir William Savage is to be congratulated on his admirable summary of the present position of canned foods in relation to health, and his paper should be read far and wide. I, for one, feel that the soul of Nicolas Appert can well rest in peace at last.

The Phosphatase Test

(Contributed)

THERE have been many opponents to the general introduction of pasteurisation, and the recent fiasco of the amended Milk Bill gives some indication of the power of these opponents. But gradually they are being driven to abandon one objection after another by the cold logic of facts. Nowadays their chief contention is that while pasteurisation may be effective in theory it is often ineffective in practice, so that the security it gives is limited. This argument has been squashed by the introduction and perfection of the phosphatase test which makes the efficient control of pasteurisation both simple and effective. The test depends on determining the phosphatase content of milk. Phosphatases are enzymes present in reasonably large quantities in all samples of raw milk, and are stable for the period which may elapse between collection and laboratory examination. They possess a resistance to heat which is slightly, but only slightly, greater than that of the tubercle bacillus and the other pathogenic bacteria found in milk. The quantitative test devised by Kay and his colleagues at Reading can, therefore, be used to assess the efficiency of "holder" pasteurisation. The test has not yet been blessed by official recognition, although the chief medical officer of the Ministry of Health, in his report for 1936, stated that "the obligation to detect in what way pasteurisation plant or technique is at fault actually rests with the licensee, and if he cannot deliver milk which satisfies the requirements of the phosphatase test he should not continue to hold a licence.

Only the holder method of pasteurisation is recognised officially with specified limits of temperature and holding time, but much experimental work has been done in this country and the U.S.A. on a different set of conditions mostly of the "high temperature short time" variety. The experimental work is, on the whole, satisfactory, so it is important to assess the value of the phosphatase test for this type of pasteurisation. Kay and colleagues have just issued a booklet which sets out the technique and utility of the test, and they sum up the position by stating that for these variations experience is still limited, "but there can be no doubt that, possibly with minor modifications, it will provide as sensitive and searching a method of control here as it has already provided for 'holder' pasteurisation". It seems to us that sufficient evidence has now been gathered to justify the phosphatase test as an official test for pasteurised milk as defined by the Ministry of Health.

Aids to Fuel Economy *(Continued from page 7)*

ing steam. A summary of these tests, which is too long to be included in this review, is very interesting, dealing as it does not only with various classes of insulation (including glass silk, which is becoming widely used), but shows definitely the need to provide the correct thickness of insulations for particular sizes of cylinders and diameters of pipes to secure maximum heat saving. All engineers interested in this matter should have this important information handy for reference.

Other Boiler-House Instruments

A review of this nature demands reference to new instruments, and attention will be drawn to sundry innovations. For smaller plants engaged in the food industry, where elaborate panels for boiler control are perhaps not called for, there are recorders and dual recorders for feed water and also for flue gas temperatures. A most recent introduction is a special low range draught gauge, which has a patented balanced diaphragm movement sufficiently sensitive to permit a range as low as minus ½ to plus ½ w.g. It has been in operation under working conditions where it was frequently overloaded by as much as 200 per cent. without the calibration being affected.

A new type of temperature recorder, which will accommodate one, two or three records, is shortly to be put on the market. As these instruments are designed for production at a comparatively low price, they should be of greatest interest to industrial plant operators.

Another instrument which has been extensively used is a portable CO_2 and temperature recorder. This employs an electrical method of indicating the CO_2 sample which has been pumped through the instrument, while the same dial that is used for indicating the temperature is employed to indicate the CO_2, and a combined gas-sampling tube and thermocouple, the latter covering a range of 0-1,000° F., is part of the outfit provided. Another production is an illuminated moving scale indicator which enables readings to be taken accurately from a considerable distance. The instrument may be employed to measure CO_2 percentage in the boiler flue gases, or as a temperature indicator.

VITAMINISING FOODSTUFFS

By the addition of vitamins to foodstuffs it is possible to give the consumer an optimum intake at a very low cost, as has already been done in such commodities as margarine, custard powder, cheese and gravy salt. Many other foods and drinks could equally well be vitaminised.

Dr. Ing. EMIL COLLETT, M.N.C.S., M.P.F., M.N.I.F.

THE QUESTION of nutrition and its relation to the improvement of the health and strength of the human race is of ever-increasing importance to all who have to deal with this subject, and much work has been done and many books and papers upon it have been published, especially in the last decade.

An outstanding publication of this kind is, in the opinion of the present author, a survey made by E. P. Cathcart and A. M. T. Murray, and published in the *Medical Research Council's Special Report*, Series No. 218, 1937. This work is a supplement to two former articles, one published in 1931 and the other in 1932, and deals with the amount and type of food eaten by representative communities in England and Scotland and by some women students. It gives the food consumption in terms of protein, fat, carbohydrates and minerals from many angles.

After having studied a number of diets at several different places and of different classes of the population, the authors come to the conclusion that few of the diets can be regarded as really poor from the standpoint of energy, protein, fat and mineral salts, but many of them, particularly in their content of "protective" foodstuffs, leave much to be desired.

As these "protective" foodstuffs are generally considered those through which the human system acquires its supply of vitamins, one must conclude it is the authors' views also that the vitamins obtained through the ordinary food supply in most cases is insufficient, and, as a matter of fact, practically all modern nutritionists are of this opinion.

Vitamin A Insufficiency

So far as vitamin A is concerned, this insufficiency is a very common phenomenon, and Dr. K. U. Toverud, in the *Norwegian Magazine for Medical Science*, No. 5, 1937, states that in the month of November of the year 1935, 28 per cent. of the school children from the western district of Aker (near Oslo) and 67 per cent. from the eastern district had a subnormal dark adaptation. In the month of March, 1936, the cases of subnormal dark adaptation were respectively 46 per cent. and 63 per cent., and in August, 1936, after the summer holidays, the figures were respectively 19 per cent. and 38 per cent. Dr. Toverud regards cod liver oil as a product that in a short time renders normal the subnormal dark adaptation.

I know personally a very well-known medical man who himself was taking about 4,000 to 6,000 IUA per day through ordinary food, but suffered from a subnormal dark adaptation which was very annoying to him as a motorist. When he took an additional amount of approximately 15,000 IUA in the form of a vitamin A oil his dark adaptation became quite normal.

Amongst the many other publications of well-known scientists dealing with the question of an insufficient daily intake of vitamins is one by Dr. O. L. Lien of the Municipal Hospital of Oslo. Dr. Lien describes in the *Journal of the Norwegian Medical Association*, No. 9, 1939, an experiment on 542 school children in the medical district of Sigdal, which is situated in the heart of Norway, where the climate is very good, and whose population is fairly well placed economically. Every day all the children had the so-called "Oslo Breakfast", which is relatively rich in vitamins, and whilst half of them did not receive any additional vitamin preparation, the other half were given a preparation containing about 10,000 IUA and 1,400 IUD every second day—*i.e.*, 5,000 IUA and 700 IUD per day. The tests were carried out from the early autumn of 1938 to the spring of 1939, and the result was that the children who did not receive the additional vitamins A and D had 44 per cent. more school absences (in days), due to infective diseases, than those who did.

Vitamin D Deficiency

That there is also a common vitamin D deficiency in Oslo is apparent from a publication by Professor Carl Schiötz in *Tidsskrift for den Norske Lægeforening*, No. 15, 1936. Professor Schiötz cites the results found by Dr. Gythfeldt, Director of the State's dental clinics of the schools, who has made a very interesting and extensive study of the dental situation of school children in Oslo. Dr. Gythfeldt found that more than 99 per cent. of all persons in that city suffer from dental caries, which for the main part are attributed to deficiency of vitamin D.

It is likewise evident from the many publications on the subject that there is also a common deficiency of vitamins B and C, but in the present paper I shall only deal with the vitamins A and D, because the loss of these vitamins during ordinary cooking is but slight, whilst the loss of vitamins B and C is great and varies considerably owing to the different ways of cooking and handling of the water in which the food has been cooked. It is therefore extremely difficult to give even an approximately correct idea of the actual intake, although the content of vitamins B and C in the raw materials may be fairly well known.

Opinions vary considerably as to a person's daily requirements of vitamins, and undoubtedly many factors influence the needs of each individual. There will be a difference in the minimum requirements varying with people's different natural dispositions and also depending upon the kind of work they do, whether hard manual work, office work, etc.

Regarding vitamin D, a unit seems to be more efficient in a milieu like milk containing the minerals lime and phosphorus than in other milieux. Whether a person has the opportunity of enjoying much or little sunshine will also make a considerable difference to his need of this vitamin.

Minima of Vitamin Requirement

The minima of vitamin requirements can, therefore, only be indicated between certain limits, but after a close study of the most reliable information available,

I believe the following to be near the correct minimum figures for a country like England:

2,000-5,000	Inter. Units	Vitamin	A,	say	average	3,500	units
About 300	,,	,,	,,	B_1,	,,	,,	300 ,,
500-1,000	,,	,,	,,	C,	,,	,,	750 ,,
400-1,000	,,	,,	,,	D,	,,	,,	700 ,,

These figures are fairly well confirmed in the following publications:

1. *U.S. Department of Agriculture, Miscellaneous Publ.* No. 275, 1937.

2. *Health Committee of the League of Nations*, Offprint No. 2 of the Quarterly Bulletin of the Health Organisation, Vol. No. 2, June, 1935. E. Burnet and W. R. Aykroyd, "Nutrition and Public Health".

3. *The Englishman's Food*, Professor J. C. Drummond and Anne Wilbraham.

4. "The Prophylactic Work for Health in Schools", *Tidsskrift for den Norske Lægeforening*, No. 9, May 1, 1939, Dr. O. L. Lien.

Several authorities are of the opinion that the optimum vitamin requirements range considerably higher than this, and an eminent authority like Professor Szent Györgyi of Hungary states that the minimum quantities which might promote good health under normal conditions will be nothing near sufficient when the organism is exposed to the special strain of having to combat infective illnesses like influenza, pneumonia, diphtheria, etc.

Assuming, however, that my minimum vitamin requirement figures are accepted, how much does an individual of, say, the middle or working classes obtain from his normal diet? The first essential will be to produce such a diet, which in itself presents many difficulties, but I have obtained what appears to be reliable information from the previously mentioned publication by Cathcart and Murray, which contains details compiled from investigations made of the quantity of different kinds of foodstuffs consumed by a number of families in various social groupings in different parts of the country.

From the data in this publication we have the amounts of different foodstuffs consumed by 114 persons, comprising 11 shopkeepers, 74 skilled and 29 unskilled workers over a period of time, and the average per person will probably give a fairly accurate picture of a working-class man's daily diet in England. This I have set out in the following table, together with the retail cost, as near as this can be judged, and the quantity of vitamins A and D which, from the best sources of information available, and partly checked by investigations of my own, should be contained in each foodstuff.

A few amplifying remarks might be advisable in regard to the vitamin figures:

Foods.	*Quantity Consumed per Week per Person in Lbs.*	*Quantity Consumed per Day per Person in Lbs.*	*Cost per Day in Pence.*	*International Units. Vitamins*	
				A.	*D.*
Meat:					
Beef, mutton, pork, bacon, ham, offal ...	2·08	0·297	4·25	135	
Fish and Game:					
Fresh, dried, smoked and tinned fish, rabbits, fowls ...	0·44	0·062	0·60	110	100
Bread:					
White (including cakes)	4·28	0·611	1·90		
Brown (and biscuits)	1·40	0·200			
Cereals and Legumes:					
Flour, oatmeal, rice, peas, beans	1·09	0·156	0·54		
Milk:					
Fresh, 4·54 pints	5·67	0·810	2·27	365	8
Skimmed ...	0·10	0·014			
Dairy Produce:					
Butter	0·46	0·066	0·82	650	12
Margarine ...	0·30	0·043	0·41		
Eggs	0·44	0·063	2·07	300	25
Cheese ...	0·18	0·026	0·27	120	
Sugars:					
Sugar, jam, sweets, chocolate	1·84	0·263	1·05		
Vegetables:					
Carrots, greens, etc.	0·85	0·121	0·81	200	
Potatoes	2·48	0·354	0·47		
Fruit:					
Fresh and dried nuts, raisins, currants ...	1·47	0·210	0·84		
Cocoa, coffee, tea	0·20	0·028	0·90		
	23·28	3·324 (3 lbs. 5 ozs.)	17·20 (1s. 5¼d.)	1880	145

Vitamin A

In vegetables is contained carotene, the pro-vitamin A (not vitamin A itself). Now it is generally admitted that carotene has a less nutritive value than vitamin A, but the correct relationship does not seem to have yet been definitely agreed upon or established, although a good deal of work has been done on the subject. Some workers give a value to vitamin A nearly ten times as high as carotene, whilst others suggest a difference as great as 20 to 1 and more, and some only state the value of vitamin A as much greater than carotene. One well-known vitamin expert, a professor in pediatrics, says that at his clinic for small children he has found a very low nutritive value for carotene, but he does not know whether the same is the case for adults. Other workers state that the ability to transform carotene to vitamin A is reduced with increasing age. Basing my calculations upon available literature and verbal information, and not yet having completed my own tests in this field, I have assumed that the nutritive value of carotene is not underestimated when a ratio of 10 to 1 is suggested, and the vitamin A figures for vegetables shown in the table are based upon this relative value, which means approximately ten times more carotene expressed in international units A than vitamin A itself is taken to have the same effect on human beings. The above refers to carotene as taken in daily food and not to carotene dissolved in fat or oil, which presents quite another picture.

There is no doubt that this relationship between carotene and vitamin A is rather arbitrary, and a claim that may be true for one person might not be correct for another. It may, for example, be said that vegetarians enjoy good health in spite of only eating vegetables (containing carotene). But it is a controversial point as to whether a vegetarian as a general rule enjoys the same health, bodily and mentally, as a person living on a mixed diet consisting of vegetable and animal food.

No regard has been paid to vitamin loss through cooking, although a certain amount might take place during this process.

If we compare the vitamins A and D contained in the raw materials of this diet with the daily minimum requirements previously mentioned, we get the following results:

Vitamins Contained in the Raw Material of Diet.	*Minimum Requirements.*	*Deficiency.*
1,880 IUA	3,500 IUA	1,620 IUA
145 IUD	700 IUD	555 IUD

Making up Vitamin Deficiency

These figures indicate a definite shortage of vitamin A and a substantial deficiency in vitamin D. How are the deficiencies in vitamins A and D to be made up? To my mind there are four possible ways.

1. Increasing the consumption of the appropriate foodstuffs.

2. Sunshine.

3. Cod liver oil or other pharmaceutical preparations rich in vitamins A and D.

4. Increasing the vitamin content in foods.

Let us study these in detail:

1. The result of taking, say, an additional 50 per cent. of the principal foods vitamin A and D containing would be:

Food.	*Lbs. per Day.*	*Cost in Pence.*	*Vitamin Content*	
			IUA.	*IUD.*
50 per cent. more milk ...	0·405	1·13	180	4
,, ,, ,, butter ...	0·033	0·41	325	6
,, ,, ,, vegetables	0·060	0·40	100	—
,, ,, ,, meat ...	0·149	2·12	70	—
,, ,, ,, eggs ...	0·031	1·03	150	12
,, ,, ,, fish, etc.	0·031	0·30	55	50
,, ,, ,, cheese ...	0·013	0·14	60	—
	0·722	5·53	940	72

This would bring the intake of vitamin A nearly up to the average minimum requirements, but it would be at an additional cost of 3s. 2¾d. per week per person, which would be quite a considerable sum added to the weekly budget of a working-class family composed of four or five people. Even then it would not by any means bring the vitamin A supply up to an optimum and would still leave a large deficiency in vitamin D.

2. Vitamin D can be produced in the body by the action of the ultra-violet rays of the sun, but in the majority of cases this is not sufficient, especially during the winter months in the Northern Hemisphere, and in countries which have a temperate climate, owing to the fact that the days are short and mostly lacking in sunshine. Advantage cannot usually be taken of the small amount of sunshine there is, for in large cities there is almost continually a layer of smoky, dusty atmosphere which absorbs the ultra-violet rays, and many people are forced on account of their work to spend most of the daytime in town. Still it should be noted that people in sunny countries like those of the Mediterranean have much better teeth than the northern people, which tends to show the vitamin D effect of the sunshine.

3. Cod liver oil is fairly cheap, but very distasteful for most people to take, and many are unable to do so at all. Some of the pharmaceutical preparations containing vitamins A and D on the market are good and palatable, but they are usually expensive.

4. Increasing the vitamin content of foods seems to recommend itself beyond any of the others. Recent research has produced vitamin concentrates free from any bad taste and smell and in various forms suitable for incorporation in practically any foodstuff at a cost which is almost negligible. Preparations of this kind in a practically odourless and tasteless form can be had at such prices that the above 50 per cent. increase of vitamins A and D would only cost a fraction of a penny per person per week instead of 3s. 2¾d. per person per week, and the cost of a really good daily increase of, say, 10,000 international units of vitamin A and 1,000 international units of vitamin D (natural vitamin D) would not exceed a penny or two per person per week.

It can be well understood that it is practically impossible to find out the real minimum and optimum requirements of vitamins for mankind. It is also impossible to establish with certainty the quantities of vitamins contained in a daily ration of food. One has to be content with approximate data, but when everything is taken into consideration and full allowances made for possible errors, there can be no doubt that the great majority of human beings are undernourished so far as vitamins are concerned, and that it is extremely difficult to cover the optimum requirements by means of ordinary foodstuffs. Any attempt to do so would be very costly, and would involve such a large amount of food being consumed that the human organisation would be quite unable to digest it.

Addition of Vitamins to Foodstuffs

By the addition of vitamins to foodstuffs, however, it is possible to give the consumer an optimum intake at a very low cost, and this is already realised by some food manufacturers, such commodities as margarine, custard powder, cheese and gravy salt being on the market containing vitamins. Many other household commodities such as milk, lard, bread, porridge, etc., could also equally well be vitaminised, as well as drinks such as fruit cordials and cocoa, ginger beer, etc. It would add materially to their nutritive value and health-giving properties at a very small cost, would not affect their taste, smell or appearance in any way, and would certainly result in an improvement in the general health of the population.

I believe many food manufacturers are to-day asking the question: Is the vitaminisation of foodstuffs a present-day fad which is being overdone, or would they be meeting a real public need by adding vitamins to their products or increasing the quantity they already contain? I have tried to place some facts and figures before these manufacturers which I hope may be of use to them in coming to a decision.

As previously stated, it is impossible in dealing with vitamins and foodstuffs to work on exact figures and data, but in conclusion I would like to make the following observations:

> Frequent cases of night blindness, rickets, tooth caries, xerophthalmia, tiredness, etc., tend to show that vitamin A and D deficiencies are frequent. Intake of relatively large amounts of these vitamins causes the above symptoms to disappear. Almost everybody will feel body and mind improved by such intake.
>
> It is practically impossible to acquire an optimal amount of vitamins by means of ordinary food and a relatively small increase of vitamin intake by this means would be costly, whereas through the more general vitaminising of food it would be easy to bring about such an optimum intake at a very small cost.

This article was written before the present war, but I do not see any reason to change or modify the views expressed. On the contrary, it might be considered more desirable, in view of a possible shortage in certain protective foodstuffs such as meat, butter and fish, to fortify other commodities of which there is not likely to be a scarcity with such essential food factors as vitamins.

Many scientists to-day consider that white bread should have vitamin B_1 returned to it in some form. As this is one of the best and cheapest sources of food energy of which there is not likely to be any shortage, why should it not now be used as a well-balanced daily diet including other essential vitamins and minerals?

Book Reviews

WILD FOODS AND A VITAMIN

Wild Foods of Britain. *Jason Hill, London.* 2*s.* 6*d. net.*

"It looks like a piece of liver jutting out from a tree trunk." That is the beefsteak mushroom (*Fistulina hepatica*), which is "excellent with stewed dried beans and makes a good *consommé*. . . ." and is one of the wild foods mentioned in this sprightly little book, the part dealing with fungi being one of the most interesting. There is apparently only one lethal fungus in this country (the Death Cap *Amanita phalloides*), and the only one commonly eaten which is liable to be confused with it by the unobservant is our chosen species, the Field Mushroom and the Horse Mushroom. There are five other edible species described with such picturesque names as Shaggy Cap, Fairy Ring, Parasol and Blewit, and the illustrations should suffice to guide the observant gatherer.

Apart from the fungi the list is disappointing, although to those living by the sea its weeds may be of interest.

Wild vegetables and herbs are described fully, but the author has had some difficulty in spreading his matter concerning flesh and fowl and fresh-water fish over more than three pages. But, as he says, "when we come to look at our wild birds and beasts in terms of their value as food, nearly all of them fall into the category either of those which we may not catch or of those which are not worth catching". Poor hunting! The rabbit is excepted, and the recipe given for its preparation looks (theoretically) as if it alone might be worth the price of the book. Now that sparrows are on the black list, the Italian version of toad in the hole made with small birds baked in *polenta* may inspire, or otherwise.

There are several little chuckles for the reader who can appreciate a perky humour. Discussing fresh-water mussel, the author says, "No method of making it edible has been discovered. Bargemen" (one likes "bargees" better) "are reported to have eaten it, but their observations have not been recorded".

If only to indicate that the hunter of wild foods in Britain must not expect a big bag, but at the same time may find one or two interesting little bits and pieces, the book is well worth reading.

T. C.-W.

Vitamin E. *A Symposium held under the auspices of the Food Group (Nutrition Panel) of the Soc. of Chem. Ind.* 5*s. net.*

Information concerning vitamin E is increasing at a great rate. Chemists are investigating its chemical nature, physiologists its action on the animal body and clinicians its value in medicine. At the symposium held under the auspices of the Food Group (Nutrition Panel) of the Society of Chemical Industry, a large number of workers who are themselves engaged in these investigations gave summaries of the facts at present known concerning this factor.

Three tocopherols, α, β and γ, all with vitamin E activity, have been recognised and synthesised, and all three forms have a chroman, not a coumaran, structure, as was at first thought. The part of each molecule which is responsible for its biological activity is not yet known, but the presence of three methyl groups in the aromatic ring (as in α tocopherol) seems to give maximum activity. β- and γ-tocopherol have only two methyl groups in the aromatic nucleus and possess only about one-half or one-third of the biological activity of the α-form. Compounds with only one such methyl group have no activity. The structure of the long aliphatic side chain, the same in all three forms, appears to be essential. Pure α-tocopherol seems to be easily oxidised, but synthetic *d l*-α tocopherol acetate has recently come on the market as a convenient stable form of vitamin E.

A chemical test for the tocopherols is based on the fact that they reduce ferric chloride; the ferrous salt thus formed is then determined colorimetrically with α:α′-dipyridyl. It can be applied to the determination of vitamin E in blood serum. In some solutions vitamin E can be estimated by the intensity of absorption at 294 mμ or by electrometric titration with gold chloride.

Recent work indicates that physiologically vitamin E acts through the pituitary, but this cannot be its only route, for implantation of fresh pituitaries has failed to prevent gestation resorption or to restore testicular structure in vitamin E deficient rats. The serum of deficient rats and of cases of habitual abortion in women has an antitryptic action, which suggests the presence of some œstrin-like factor which is not detectable in the serum of normal animals. "Hormone imbalance" may perhaps describe, though vaguely, the state of vitamin E deficiency. The biological methods of determination were discussed, but it was pointed out that these methods only allowed comparisons between two or more preparations at one and the same time, and that, without a standard of reference, no absolute determinations could be made.

Many reports of good results from vitamin E therapy in cases of habitual abortion in cows, sows and women were given, but controlled work with large animals like the cow and sow is very difficult and with women almost impossible. One worker reported success with vitamin E treatment in cases of habitual abortion and failure in cases of threatened abortion. Another worker reported exactly opposite results. Another quoted equally good results with progesterone, vitamin C or pregnancy serum. Malpas had shown that after one, two or three spontaneous abortions, the chances of the next pregnancy being carried to term are 78, 62 and 27 per cent. respectively, which must be taken into account in assessing the value of any specific remedy. Hence, although vitamin E has been shown by experiment to be necessary to the rat, it cannot yet be said that it has been shown to be so for the human being.

K. H. C.

Correspondence

The Editor.

DEAR SIR,

We note that in your issue of November 3 you mention in response to an enquiry that the circumstances of the Norwegian fishing industry make it possible to produce cod liver oil in a very fresh state. Real and complete freshness in cod liver oil cannot be achieved under any conditions where shore rendering is practised because of the extremely perishable nature of cod livers. The British industry has overcome this difficulty by actually producing the oil at sea as soon as the fish are caught. The facts behind the British industry have been widely published, and particularly the fact that sea rendering gives the very freshest possible type of cod liver oil.

In view of the fact that your reply, mentioned above, might create some misapprehension in the minds of your readers, we would ask you in an early issue to make the true facts of the situation as regards the British industry clear.

Yours faithfully,

FOR BRITISH COD LIVER OIL PRODUCERS (HULL), LTD.,
K. MACLENNAN,
General Manager.

PLANT AND MACHINERY

Stainless Steel

In spite of every care during manufacture, it is not sufficient to assume that all stainless steels so produced are likely to be equally successful in any application. Special conditions require special steels and, while each is equally successful under the circumstances for which it was particularly designed, there is no small risk of a purchaser securing a steel which could be improved upon for the purpose in view, if the original enquiry fails to indicate prospective service and other data likely to assist the maker in providing the most appropriate brand. Samuel Fox and Co., Ltd., have issued a booklet on "Silver Fox" stainless steels giving details of the range of these steels. Also included in the booklet are tables on corrosion resistance, and a section on machining. This section deals with the technique of turning, drilling, tapping, etc., giving notes and tables on each operation. The suggestions only indicate the more generally accepted principles, as many machinists probably have a long record of success achieved with detailed procedures of their own.

* * *

Copper and Copper Alloys

A generation ago the publication of a book on the machining of copper alloys could have served no useful purpose. Machine tools were by modern standards simple in construction and general in purpose, whilst tool materials were limited in capacity. Machining operations were carried out by craftsmen who ground their own tools and selected their own feeds and speeds. The copper alloys which they machined were limited in number and were regarded as essentially free-machining by comparison with iron and steel. Moreover, each alloy possessed its own well-defined field of application.

To-day in a modern production shop the craftsman has been replaced by a team of specialists, whilst many machine tools are so completely automatic that the duties of the operator are reduced to the pressing of a button.

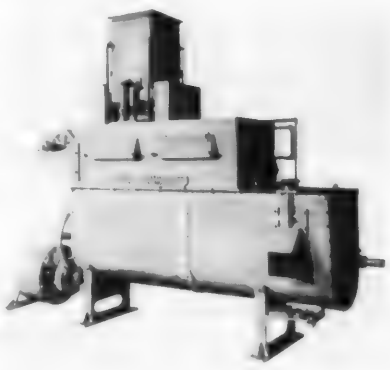
In so far as copper alloys are concerned, the range of materials available to the engineer has been very widely extended, notably by the introduction of new high-strength materials such as manganese-, aluminium-, silicon- and beryllium-bronzes. Copper alloys with an ultimate tensile strength of 40 to 50 tons per sq. in. are now commonplace, whilst for special duty, strengths up to 80 tons per sq. in. can be developed by means of heat treatment.

The Copper Development Association have published a book on *The Machining of Copper and Its Alloys*, which discusses in a comprehensive manner the machining properties of copper and copper alloys, and summarises modern machining practice as applied to these materials. It is intended to serve both as a practical handbook and as a guide to the selection of materials for machined products.

* * *

Fusion Welding

The fusion welding process of making joints in boiler plate, etc., is a metallurgical process as compared with the mechanical engineering involved in making the riveted joints. Various physical tests and metallurgical examinations are carried out, the latter being of great importance in revealing defects in welding methods and at the same time indicating where improvements are necessary. Daniel Adamson and Co., Ltd., of Dukinfield, have a special department which has been equipped with the most modern available apparatus necessary for the research and testing in connection with the various problems associated with Class 1 fusion welding technique and for the more general highest grade engineering requirements. By reason of the considerable advances in the quality of welded joints as a result of the constant improvements in the quality of the welding rods and equipment available, modern welded joints of high quality are required to withstand satisfactorily more onerous service conditions, with higher working stresses, and it is now generally accepted that such welds should be examined by means of X-rays and tested in various ways. Such tests and examinations are carried out with specialised laboratory equipment as illustrated in the Company's brochure, *Fusion Welded Pressure Vessels*, 2nd edition. The work also provides illustrations of the numerous types of welded vessels made at the works—condensers, storage tanks, evaporating columns, stills, and so on. Some of the rules and regulations covering the standards of fusion welding which have been issued by recognised authorities are included in Section 2 of the brochure.



Mixing Machines

A Combined All-Metal Feeding and Spraying Apparatus working in conjunction with a continuous "Rapid" mixer, the drive being through gear, fast and loose pulleys, is shown in the illustration.

This is one of the items of specially designed plant recently produced by Wm. Gardner and Sons (Gloucester), Ltd.

Garner's patent "Rapid" mixer direct coupled to geared motor by means of flexible coupling is another specially designed item of plant.

It is of interest to note that the same firm's patent "Rapid" Combined Sifting and Mixing Machines and also their patent "Rapid" Mixers can be arranged with agitators of various forms to suit any working conditions, and it is also a great point that these machines are specially arranged for ease of cleaning.

* * *

Cardboard Box Machinery

Every cardboard box manufacturer is aware of the vast and still growing demand for high-class round, oval and fancy-shaped drawn boxes. Practically any class of cardboard is suitable for drawing up into shapes, providing it is first properly "matured". This process consists of coating what afterwards will form

the outside of the box with a weak soap solution, and all traces of this soap are removed by subsequent operations.

Hunter-Penrose, Ltd., are manufacturing various types of machinery for producing food containers, such as tube-winding machines to make paper tubes, automatic drawing press to make drawn caps, beading machine to insert the drawn cap into the end of the tube and continuous waxing machine to render the assembled container waterproof. These lines of machinery are generally employed to produce cylindrical and conical containers to replace tin containers, the plant being varied to suit individual needs.

* * *

Albro-Fillers and Engineering Co., Ltd.

Correction

The illustration appearing under "Powder Filling Machine" on page 367 of the November 3 issue was a Combined Vacuum Operated Filling Unit with built-in agitator for handling liquids containing solids in suspension, and not the machine described in the caption. The "Albro" double-head semi-automatic powder filling machine, which is completely dustless in operation and works on the vacuum principle, is another of the company's specialities.

* * *

Process Controllers

Controllers, pressure gauges and thermometers of all sizes and shapes and for all kinds of work are illustrated and described in a book recently issued by Short and Mason, Ltd. Sufficient theory and description have been included to emphasise the main considerations when dealing with these instruments, which, it is said, are the products of research and development, supported by a knowledge of industrial requirements.

The development of flow controlling instruments has naturally followed the increasing use of continuous processes and the demand for more accurate control of the process throughout all phases. Automatic control of the flow rate is the most fundamental point of application of control on a complex and continuous process, and materially simplifies the control of temperature, pressure and liquid level. Controllers for regulating flow are primarily flow-measuring instruments with added mechanism for maintaining a constant differential pressure.

The heart of the Short and Mason Controllers—whether for rate of flow, liquid level, temperature or pressure—is the Universal Sensitivity Adjuster. The purpose of this mechanism is to throttle the air supply to the diaphragm-controlled valve, in response to process demand. The smoothness and precision of the throttling action determine to a large extent the character of the control results.

This is but one of the industrial instruments described in the catalogue by Short and Mason, Ltd., which also includes lists of charts suitable for mercury-actuated instruments, Fahrenheit or Centigrade, pressure and humidity and for vapour-actuated instruments.

* * *

Distant Repeater

The Distant Repeater is an electrical instrument for transmitting information to a distance and for controlling distant apparatus. Any angular movement, even if the operating forces are relatively weak, can be indicated or recorded at a distance by this apparatus. Varying measurements can be taken such as electrical quantities of amperes, volts, watts, steam and water pressure, steam, water and gas flow, water level in reservoirs, volume of gas in gasholders and so on. Other functions performed by this apparatus are the selection and control of distant switchgear and the summation of two or more measured quantities such as electrical power or gas or water flow. Evershed and Vignoles, Ltd., of Chiswick, have issued a leaflet describing the characteristics and construction of the Evershed-Midworth Distant Repeater, illustrating it with diagrams and photographs of actual installations.

They have also issued a concise and practical handbook on *Earth Testing*, which should prove useful to engineers entrusted with the installation of earth electrodes and the maintaining of them in efficient condition.

* * *

Complimentary Colour Lighting

So much has been said and written about complementary colour lighting that many factory executives are in a quandary—should they adopt it for their factory or not?

Metropolitan-Vickers Electrical Company are confident that their Traffoblak system developed in their Trafford Park Research laboratories is perfectly satisfactory. It has been well tried out and is now being used by an increasing number of factories throughout the country. Here is a brief outline of its principles:

All the artificial light used inside the building must be of a monochromatic orange colour which at night-time is absorbed by a blue lacquer applied to the window and roof glass—*i.e.*, no light is visible outside the building. During the daytime, however, daylight is available through the blue lacquer.

Three artificial light sources have been developed of which the most efficient is the "Metrovick" Traffoblak Sodium lamp, a standard Sodium Discharge lamp fitted with a special coloured glass filter, now the subject of a patent application. This lamp gives a light output equal to 60 per cent. of the Sodium Discharge lamp output when not filtered.

Tungsten filament "Cosmos" lamps are being manufactured either sprayed or in natural amber glass bulbs, but due to the amount of colour correction necessary are considerably less efficient than the Traffoblak Sodium lamp.

Metrovick Traffoblak lacquer used for the roof and window glass if applied in accordance with the manufacturers' instructions will neither fade nor peel off.

If you want to make a change in your hastily blacked out factory, do not lightly dismiss the complementary colour system. Providing your window space is in reasonable proportion to the floor area your operatives will be able to work in adequate daylight and your factory will be effectively blacked out at night.

* * *

Tests for Air-Raid Shelters

Six tests have been carried out on two different types of air-raid shelters. The objects of the tests were to determine the length of time the full complement of occupants could remain inside without undue discomfort, with entrance and exit completely sealed; to obtain any data of physical, physiological, or psychological nature which would be of value should the shelters be used during air raids, as well as information which might indicate in what ways the conditions inside the shelters might be controlled or improved during prolonged occupation. The occupants for the tests were selected from as wide a range of age and vocational groups as possible. Minute details were taken of the results of the tests, the condition of the air, the reactions of the people, and so on. These particulars have been gathered together and carefully set out by J. and E. Hall, Ltd., of Dartford, at whose works these tests were carried out.

* * *

Patents and Trade Marks

Any of our readers requiring information and advice respecting Patents, Trade Marks or Designs should apply to Messrs. Rayner and Co., Patent Agents, of Bank Chambers, 29, Southampton Buildings, London, W.C. 2, who will give free advice to readers mentioning this paper.

INFORMATION AND ADVICE

Vegetable Extracts—Producing a Vacuum in Fruit Bottling—Filters for Worcester Sauce—Hoists and Elevators.

Vegetable Extracts

5,856. *We shall be very obliged to you if you will let us have the following recipe:*

Manufacture of vegetable extracts for soups and pottages. These extracts proceed from yeast, to which salts and spices are added. We would like to obtain some formula, starting from unextracted beer yeast. (Belgium.)

We have pleasure in giving you the following information with regard to the manufacture of extracts from yeast:

Most of the processes for making yeast extract depend upon a partial digestion of the cells by the enzymes of the yeast (autolysis). In this process the dried yeast is usually ground to rupture the cells as much as possible so as to liberate the enzymes, and then it is allowed to autolyse with the addition of a small amount of a suitable preservative such as SO_2, in order to prevent putrefaction.

The autolysed yeast is then extracted several times with hot water, the extract being separated from the cells either by centrifuging or by settling and running off the supernatant liquor.

The collected extracts are then evaporated in an open-jacketed pan (or preferably a vacuum pan) until a semi-solid mass results. The requisite amount of salt should be added when partially evaporated.

If an open pan is used to evaporate the extract, the final product will produce a cloudy solution, due to the fact that some of the protein has been coagulated or denatured. On the other hand, if the evaporation is carried out under vacuum this is prevented, and a much better and more soluble extract results.

For vegetable extracts the material is merely boiled with successive quantities of water, and the collected extracts treated as described.

Other processes involve the partial breakdown of the vegetable tissues by boiling (preferably under pressure in an autoclave) with dilute hydrochloric acid. This operation achieves a similar result to the autolysis described for yeast. After extraction with two or three changes of water and finally pressing, the collected extracts are mixed and made neutral by the addition of the calculated quantity of caustic soda. In this way common salt is formed in the extract, as a result of the neutralisation, and this obviates the necessity of adding salt after the evaporation.

Producing a Vacuum in Fruit Bottling

5,630. *We are bottling in 2-lb. jam-jars, using patent clip-on caps, with spring clips for processing, and find that we can only get about 65 per cent. results We seem to get vacuum in practically every instance, but on removing the clips, however carefully this is done, the vacuum is sometimes released. Our jars are ground to give a perfect "seat" to the rings and caps, and we have even tried processing with two and three clips on each jar. The caps are perfectly plain-topped, with no groove in which to fit the flat ring, and we are processing according to the directions given in the Ministry of Agriculture handbook on the subject.*

We shall be most grateful for any advice which you can give on this matter.

This is just one of those problems which crop up in practice which do not find their way into articles or textbooks. We note that you are only getting 65 per cent. results, but that you seem to get a vacuum in practically every instance. If it is really correct that you are getting a vacuum in every instance, it can only mean that there is not a proper closure between the caps of the bottles, and when the clips are taken off air is able to enter.

We suggest that you might test the matter of the vacuum with an appropriate instrument (name of instrument maker given) which indicates the amount of vacuum in any jar by perforating the metal cap. Another alternative, of course, is that you may not be heating the contents of the jars sufficiently to produce a high enough vacuum.

We also suggest that your most direct way would be to call in a consulting expert who could examine the trouble on the spot, and no doubt put you right almost immediately. Should you desire this, we would have pleasure in giving you the name of one. You will understand, of course, that many of these problems require investigation on the spot, and in this case we can only suggest lines of enquiry by correspondence.

Information Supplied

5,903. *We shall thank you if you will kindly put us in touch with makers of filters or some such similar arrangements for straining sauce such as Worcester sauce.* (Bombay.)

The names of a number of firms were given.

5,910. *We should be glad if you could give us the names of firms manufacturing hoists for use in connection with autoclaves, and also for elevators for packets weighing 500 kg.* (Syria.)

The names and addresses of various firms were supplied.

World copyright in this feature is fully reserved. No extracts without permission.

RECENT PATENTS

These particulars of new patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Abstracts of Recent Specifications

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, either sheet by sheet as issued on payment of a subscription of 5s. per Group Volume, or in bound volumes price 2s. each.

Extracting Vegetable Oils

Coconut oil is obtained from coconut meat by comminuting the meat, mixing it one or more times with water, pressing the mixture to separate out an oil-in-water emulsion, and then breaking the emulsion by adjusting the *p*H value to from 3·0 to 4·6 by the addition of alcohol. In carrying out the invention, comminuted coconut nut is passed through a press with water at a temperature of 22° to 100° C. one or more times, and the meat separated from the liquid. If the separated meat is to be used as a desiccated coconut for human consumption, fresh meat should be used and should be peeled before comminuting and pressing. The liquid, after separation of the aqueous layer, is centrifuged to separate protein, and the emulsion is then broken by either (1) adjusting the *p*H value by treating with an organic or inorganic acid—*e.g.*, acetic or hydrochloric acid—acid salts, or a buffer combination; (2) inoculating with a micro-organism which has the property of effecting a fermentation with the formation of acid substances such as lactic, acetic or butyric acids; or (3) adding an alcohol—*e.g.*, ethyl alcohol. The aqueous layer may be used for acetic, propionic, butyric or alcoholic fermentation, or, after the addition of sugar and fermentation, for the production of coconut toddy. The broken emulsion is centrifuged to separate protein, or is decanted, and the cloudy oil obtained clarified by heating and filtering. The protein from the centrifuges is heated and then pressed to recover oil, the pressed protein cake being utilised for human food. In a modification the emulsion is broken by adding an alcohol and conjoint adjustment of *p*H value to between 2·5 and 7. Specifications 303,413 and 326,195 (both in Class 91) are referred to.

According to the specification as open to inspection under Sect. 91, the emulsion may be broken by heating to a temperature not above 280° C. This subject-matter does not appear in the specification as accepted.

505,277. Lava, V. G.

Latest Patent Applications

25079. Caputi, C. A.: Process of producing edible flow from bread fruit. September 18.

25816. Jaffe, M.: Device to contain foodstuffs and preserve same against contamination by gas, etc. September 14.

26001. Rivoche, E. J.: Drying of foodstuffs. September 18.

24497. Bramigk and Co., Ltd. (Gernhardt): Apparatus, etc., for preserving food. August 25.

24857. Little, S. G.: Vending and storing food, etc. August 30.

24726. Musher, A.: Food products. August 28.

24590. Smith, E. J.: Method for preserving foodstuffs. August 26.

24773. Standard Brands, Inc.: Manufacture of baked goods. August 29.

30493. Ruzek, P. P.: Treatment of fats. November 21.

30483. Reid, C.: Energisation of liquids, juices, etc. November 21.

30284. Le Boulenge, A. P. L. X.: Manufacture of foodstuffs. November 17.

29917. Ormrod, H., and Nelson Preserving Co., Ltd.: Machine for inserting disc closures or lids of cardboard, etc., into mouths of paper, etc., containers. November 13.

29894. Stewart and Co., Ltd., D. (Feltham, Dymond and Murray): Apparatus for taking samples of sugar cane. November 11.

29808. Horvath, E. von.: Process and apparatus for reconditioning and preserving grain, vegetables, etc. November 10.

29731. Krim-Ko Co.: Chocolate or cocoa drinks. November 9.

29477. Stevens, A. H. (International Papaya Corporation): Treatment of papaya. November 6.

29333. Stein, L., Walsh, J. F., Needle, H. C., and American Maize Products Co.: Manufacture of syrups. November 3.

28861. Bartoli, A. G. A.: Method and apparatus for extracting liquids contained in jellies, etc. October 27.

28891. Goldingham, A. S. H. W.: Grass, corn or root drier. October 28.

29179. Holly Sugar Corporation: Process of treating finely divided calcium carbonate material. November 1.

28847. Vitamol, Inc.: Dry powder vitamin product. October 27.

28831. Westinghouse Electric International Co.: Food-preserving apparatus. October 27.

Complete Specifications Accepted

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

513,896. McLean, A., and Imperial Chemical Industries, Ltd.: Extraction of protein from ground nuts.

513,908. Lyons and Co., Ltd., J., and Gluckstein, L.: Preservation and storage of perishable articles.

514,281. Samson, H. S.: Production of whippable milk preparations.

514,151. Hughes, C. L. (Little, Inc., A. D.): Apparatus for the sterilisation of food products.

514,102. Kellog, Sen., J. L.: Production of puffed cereal products.

515,089. Webber, W. W., and Fullers, Ltd.: Wrapping of cakes or other articles.

514,987. Submarine Signal Co.: Method of treating milk.

514,918. Laing, J.: Apparatus for preserving food.

514,909. Stewart Automatic Freezers, Ltd.: Soft ice cream freezing machine.

514,828. Routh, A. C.: Manufacture of margarine.

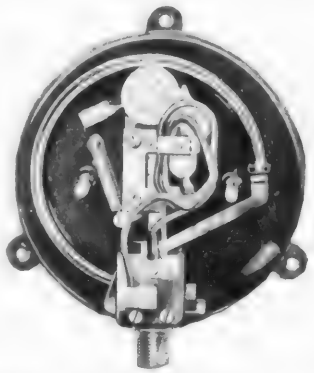
514,618. Carring, C. A. C.: Apparatus for producing portions of desired size and or shape from a mass of soft but solid consistency—for instance, butter.

514,492. Submarine Signal Co.: Method of treating milk to obtain a product of reduced curd tension.

514,424. Hopkinson, L. T.: Method of producing oil from fat-containing protein material.

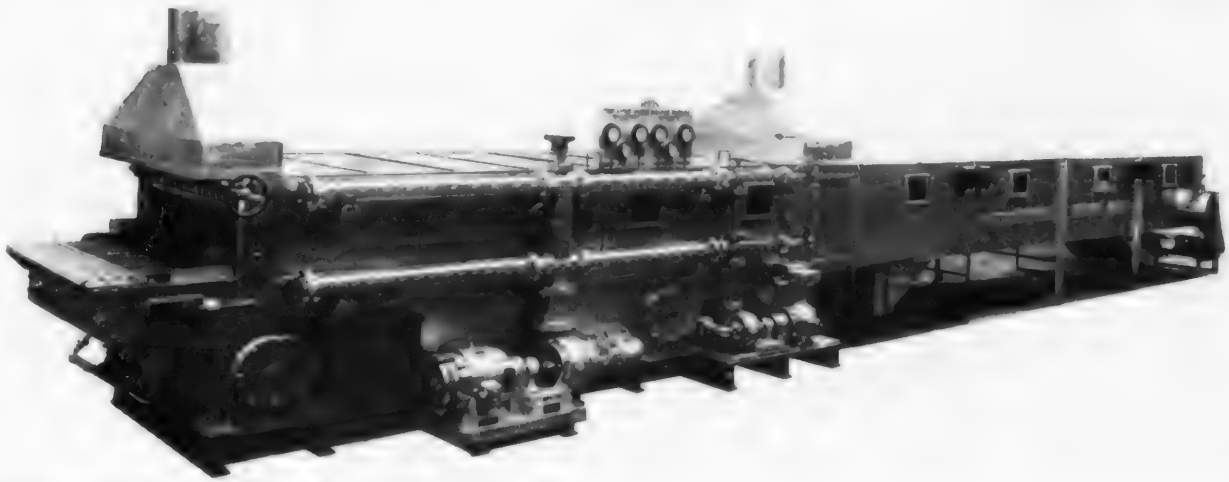
INSTRUMENT

Boiler Pressure Control



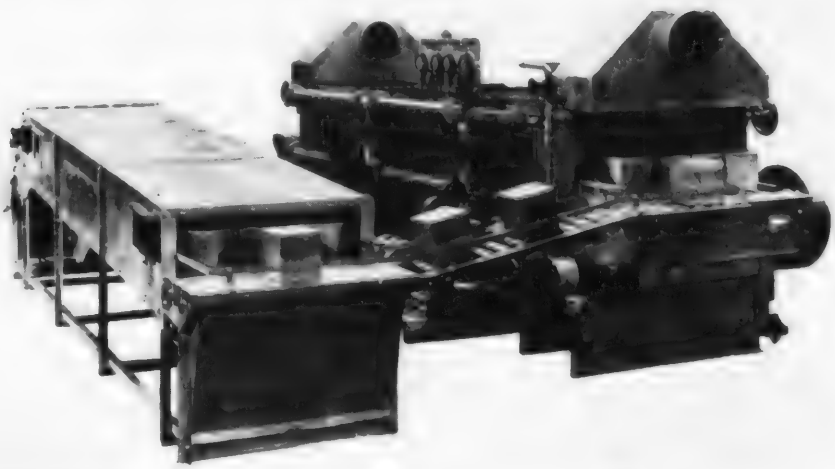
"Teddington" Model FZ Instrument made by the British Thermostat Co., Ltd., Middlesex.

"KELLIE" *Continuous* HYDRO-ELECTRIC WASHING MACHINES



Photograph by courtesy of Messrs. Scribbans & Co. Ltd., Smethwick, Birmingham.

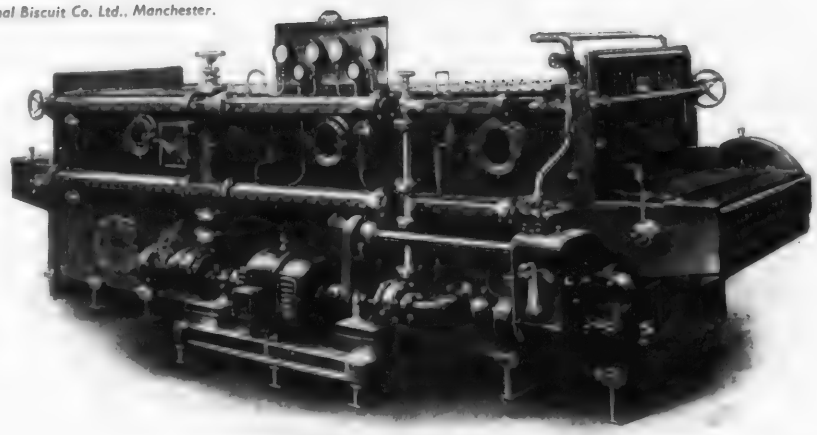
Machines designed for any desired output



Photograph by courtesy of Messrs. International Biscuit Co. Ltd., Manchester.

Illustrations show three of our latest machines specially designed for washing and drying biscuit tins, bakers' wooden boards, trays, pans, wire mats and baskets, pie, sponge and tart moulds, buckets, jam jars, fruit bottles, etc.

Original makers of Continuous Hydro-Electric Washing, De-labelling, Rinsing and Drying Plants for all types of wide-mouthed glass, stone and metal food containers.



Photograph by courtesy of Messrs. T. Wall & Son, Ltd., London.

Send us your enquiries

ROBERT KELLIE AND SON, LTD.

THE DUNDEE FOUNDRY **DUNDEE**

MAKERS OF FOOD PREPARING & CANNING MACHINERY & PLANTS

Telegraphic and Cable Address: "KELLIE," Dundee.
Manchester Representative: A. E. FIELDING, Queen's Chambers, 2 Ridgefield, Manchester.
Telephone: 2819 (3 lines)
Telephone: Blackfriars 0449.

Facing last page of Editorial

STURTEVANT
Registered

A bakery equipped with Sturtevant Heating and Ventilating Plant

HEATING AND VENTILATION

for reasonable temperature and effective ventilation

Full particulars and illustrations are given in our publication W1260

STURTEVANT ENGINEERING CO. LTD. 149, QUEEN VICTORIA ST. LONDON E.C.4

Dress your products in

GLASSWARE

From our full range of Glassware we can supply a bottle or jar suitable for any product, a container that will display the contents to advantage, and attract the attention of women who want to see clearly what they are buying.

Jam Jars, Honey Jars, Pickle Bottles, Sauce Bottles, Lime Juice Bottles, Paste Jars, Salad Cream Bottles, Coffee Extract Bottles, Lemon Curd Jars, etc

LAX & SHAW

Regd. Office : LIMITED

ALBERT GLASS WORKS, HUNSLET, LEEDS, 10

Also at CLARENCE GLASS WORKS, DONISTHORPE GLASS WORKS

Grams : "Feeders, Phone, Leeds." Cables : "Feeders, Leeds."

Phone : 21568 (2 lines).

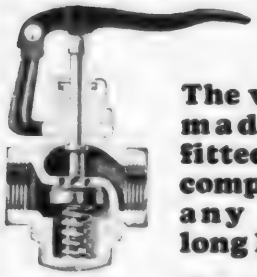
London Office : ST. MARTIN'S HOUSE, 29 LUDGATE HILL, E.C.4

Phone : City 7170

VALVES

FOR STEAM AND WATER SUPPLIES— QUICK AND EASY TO OPERATE

No. 70



No. 76

The valves are heavily made in gunmetal, fitted with renewable composition discs for any service, giving long life with low cost.

We specialise in reducing valves, steam traps, & control valves for any duty.

BRITISH STEAM SPECIALTIES LTD.

FLEET STREET, LEICESTER

NEW EDITION

Campbell's Book

CANNING · PRESERVING · PICKLING

OVER 600 PAGES

Section

I Canning
II Preserving
III Tomato Products
IV Pickling
V Sauces and Condiments
VI Miscellaneous Products

Order Now* 50/- *From

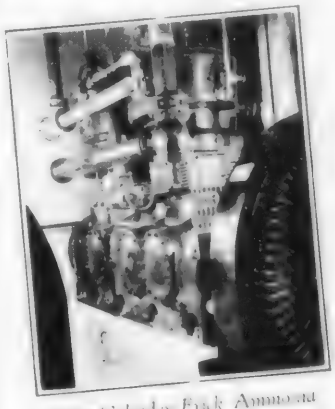
LEONARD HILL LIMITED

17 Stratford Place, London, W.1

Refrigeration

Comes in big units, these days, as if recalling the giant Frick machines of forty or fifty years ago.

The Frick ammonia compressors illustrated have four cylinders, each of 12-in. bore and 12-in. stroke. Other sizes range from 10 in. by 10 in. to 15 in. by 10 in., the largest being adapted either to ammonia booster service on low-temperature work, or to handling Freon-12 for air conditioning.



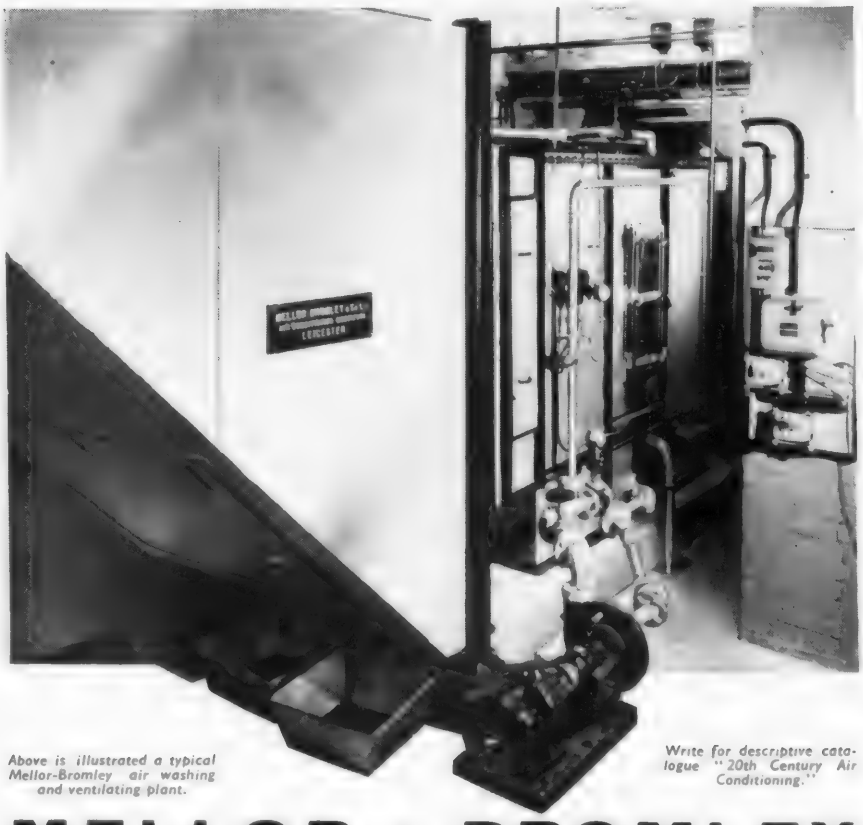
Four Cylinder Frick Ammonia Compressor with Direct Motor Drive

Whether you need a quarter of one ton of refrigeration or a thousand tons, there's a Frick system of the size and type to do the work dependably and economically. Installations throughout the world. Write to-day, giving details of the cooling work you wish to do.

DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.



Above is illustrated a typical Mellor-Bromley air washing and ventilating plant.

Write for descriptive catalogue "20th Century Air Conditioning."

MELLOR • BROMLEY

AIR CONDITIONING ENGINEERS

Mellor, Bromley & Co. Ltd., Minotaur Works, St. Saviour's Road, East, Leicester

Several years ago we became interested in Humidification in an industry in which we were acknowledged authorities. Since then we have installed many thousands of pounds worth of plant in that industry.

Realizing that other industries needed plants of a similar nature we augmented our staff with a number of specialists in Air Conditioning plant . . . designers who had been in Air Conditioning since the early post-war days . . . draughtsmen who knew the difference between mere ductwork and scientifically designed Air Conditioning ducting . . . technical men who have studied Air Conditioning and are qualified engineers—backed by the resources of a large modern engineering establishment . . . and now produce Air Conditioning equal to the best and better than most.

Readers!

Save the money you have spent!

Put the year's copies of "FOOD MANUFACTURE" in a binder and save them from damage.

Specially designed to hold from one to twelve copies firmly, this attractive binder will keep your copies clean and preserve their edges.

Do you not often require information from back numbers of "FOOD MANUFACTURE"?

There is no need to search through files of them for information—just refer to the distinctive binder on your shelf, and save the inconvenience of curled-up leaves, dirty pages and "lost" copies. Smart in appearance, gold lettering on green, it is a handsome addition to your bookshelf; a matter of seconds to insert the journal.

"FOOD MANUFACTURE"

Volume Binder

5/9 U.K. 7/6 elsewhere

Post Free

Obtainable from the Librarian, "FOOD MANUFACTURE," 17 Stratford Place, LONDON, W. 1

Mayfair 7383

Indispensable

BRITISH MADE

WHAT the slide-rule is to speedy and accurate calculations, so is the Model 7 AvoMeter to electrical testing—Indispensable! With 46 ranges, measuring A.C. and D.C. Amperes and Volts, Resistance, Capacity, Audio-frequency Power Output and Decibels, it provides unrivalled test facilities in the most convenient form. Compact and portable (it weighs only 6 lbs.), it conforms to B.S. 1st Grade accuracy requirements.

● *Write for fully descriptive literature and current prices.*

Also Available

Model 7 Resistance Range Extension Unit (for measurements from 1/100th ohm upwards).

The 40-range Universal AvoMeter.

The 10-range D.C. AvoMeter.

Model 7 Universal Transformer.

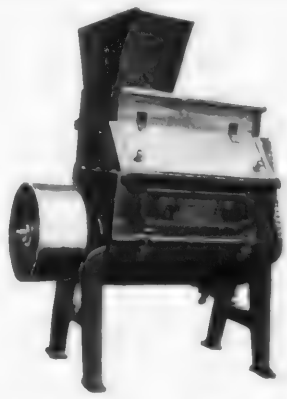
The 46-RANGE UNIVERSAL

AVOMETER

Regd Trade Mark

Electrical Measuring Instrument *Model* 7

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD
Winder House, Douglas Street, London, S.W. 1. *Phone: VICtoria 3404-7*



GRINDERS, CRUSHERS, SIFTERS, MIXERS, DRIERS, ETC.

WE HAVE SPECIALISED ON THIS CLASS OF MACHINERY FOR 35 YEARS

W. S. BARRON & SON, LTD.

TELEPHONE (DEPT. A): 2255 GLOUCESTER GLOUCESTER TELGRAMS: BARRON, GLOUCESTER

POSTLIP PURE FILTER PAPERS

FOR FOOD MANUFACTURERS

Crinkled White and Grey in large sizes for Filter Presses, White and Grey in various qualities, in circles and squares for Laboratory Work.

Trial Sample on application to the Makers.

EVANS, ADLARD & CO LTD

Postlip Mills, Winchcombe, CHELTENHAM, Eng.

ROSE CONTAINERS

BRITISH MADE ON BRITISH MACHINES

Owing to the use of our own designed high-speed Carton-making machinery we are able to offer Cream and Ice Cream Cartons at an attractive price for immediate or future delivery.

For samples and prices apply to

ROSE CONTAINERS LTD.

ALBION WORKS, GAINSBOROUGH

Inventors and makers of Automatic Machinery for Milk and all other kinds of Cartons. Enquiries invited.

GAS-HEATED **RETORT**
& BOILER COMBINED

Experimental size for

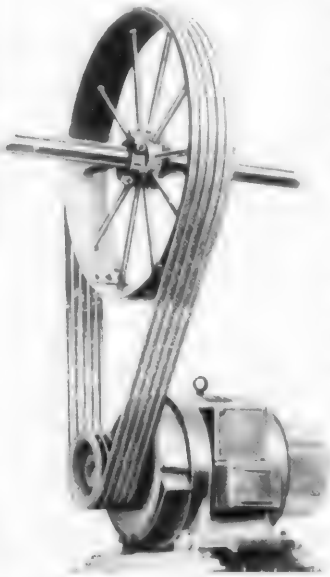
MEAT
FISH
FRUIT
VEGETABLES

NO STEAM PIPE CONNECTIONS

"MILLWALL"

PRODUCTION BY
JOHN FRASER & SON, LTD.
ENGINEERS AND BOILER MAKERS
MILLWALL, LONDON, E 14 Phone: EAST 1185 (Private Branch Exchange)

THE NOTED PULLEY HOUSE
Manufacturers of the Collingwood Endless Vee Drives



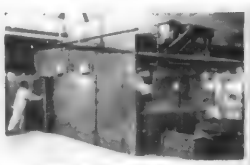
SPECIALISTS SINCE 1880 IN EVERYTHING FOR EFFICIENT **POWER TRANSMISSION**

THE **LARGEST STOCK** OF POWER TRANSMISSION APPLIANCES IN THE BRITISH ISLES

•

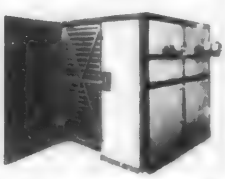
SEND FOR **ILLUSTRATED CATALOGUE**

THE LONDON SHAFTING & PULLEY CO., LTD.
COLLINGWOOD IRONWORKS, NORTHDOWN STREET
KING'S CROSS, LONDON, N.1
Telephone: **Terminus 4731, 4732**

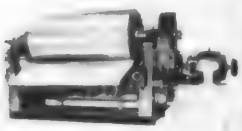


Hot Air Drying Stove

Continuous Band Dryer



Small Compartment Drying Stove



Film Dryer

Mitchell

Drying Plants & Process equipment of every kind for

PEPPER
SPICES
VEGETABLES
FRUITS
CANDIED PEEL
CEREALS
ALMONDS
STARCH
CRUSTING STARCH BLOCKS
SUGAR
MALT EXTRACT
FOOD COLOURS
SALT
DEXTRINE
CHEMICALS
SAUSAGE MEAL
DOG BISCUITS
GELATINE
ETC., ETC.

L.A. MITCHELL LIMITED
37, PETER STREET MANCHESTER
Associated Works:
PRATCHITT BROS LTD. CARLISLE.

MALT EXTRACT

The Muntona Works are one of the best equipped in Europe for the manufacture of all types of Malt Extract and Malt Flour.

Every batch of our products is ANALYSED BEFORE DISPATCH, guaranteeing uniform quality with every delivery.

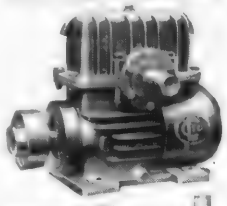
Our whole experience is at your service.

Your enquiries will receive prompt and EXPERT attention

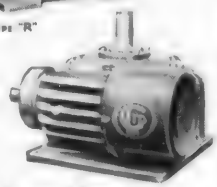
MALT FLOUR

MUNTONA LTD. BEDFORD. TEL.: 2217

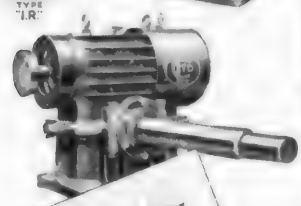
STOCK WORM GEARS



STANDARD TYPE "R"



VERTICAL TYPE "V.R."



INVERTED TYPE "I.R."

Delivery within 24 HOURS

Exceptional manufacturing facilities enable us to guarantee Delivery within 24 hours of our Patent Dual Fan Cooled "Radiation" Worm Reducers.

Stock Ratios are from 10 to 1 up to 50 to 1. Powers range from fractional up to 75 H.P.

Non Stock Ratios within 2 to 3 days.

We also stock Baseplates and Flexible Couplings, and can despatch complete Motor Drives including Motor and Gear Units lined up, coupled together and mounted on Combination Baseplate within 24 hours of receipt of Electric Motor.

N.B.—We have special arrangements for quick delivery of Electric Motors.

ASK FOR STOCK LIST 3827

CROFTS
(ENGINEERS) LTD
THORNBURY
BRADFORD
TELEPHONE · 4901 · 6 LINES

Ask for your copy of our current Stock List of Worm Reducing Gears

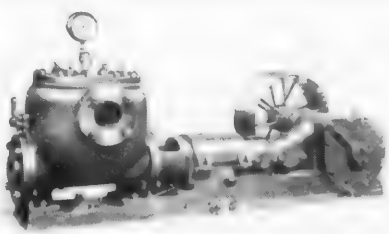
HUMIDITY CONTROL

BIRLEC
AIR-CONDITIONING TYPE LECTRODRYERS

provide easy, cheap, continuous and positive control of humidity in Tablet Rooms, Coating Pans, and many other sections of the Pharmaceutical Industry. BIRLEC have the engineers qualified to give expert advice on all drying problems.

Write for descriptive literature.

BIRMINGHAM ELECTRIC FURNACES Ltd.
ERDINGTON BIRMINGHAM, 24



VACUUM PUMPS

WET AND DRY TYPE FOR STEAM, BELT OR ELECTRIC DRIVE, FROM 3 to 24 ins. BORE CYLINDERS.

APPLY FOR CATALOGUE No. 41 B

JOSEPH EVANS & SONS
(WOLVERHAMPTON) LTD.

Culwell Works, WOLVERHAMPTON.

Grams: Evans, Wolverhampton. *Phone:* 20864 & 5 Wolverhampton.

LONDON OFFICE: 109, KINGSWAY, W.C.2.

Phone: Holborn 1091. *Grams:* "Dryosbo, Westcent, London."

ACCURATE HUMIDITY CONTROL

These instruments are employed to control electric current according to the changes in the relative humidity of the surrounding atmosphere, and can be used to operate motorised valves and control electric heaters, test rooms, humidifiers, de-humidifiers and air-conditioning plants.

Full details as to models and electrical characteristics are given in Leaflet No. 33. Copy sent on request.

THE C. L. B. HYGROSCOPE

By means of this instrument the moisture content of substances can be obtained with accuracy in a few minutes.

Fully descriptive Leaflet, No. 30, sent on request

THE C. L. BURDICK MFG. CO. LTD.
40-44 HOLBORN VIADUCT, LONDON, E.C. 1

Telephone: HOLborn 5705

INSTALL "Calorier" UNIT HEATERS AND ENSURE . . .

- a comfortable uniform temperature.
- no overheating.
- adequate circulation of cool fresh air in summer.

CALORIER UNIT HEATERS cost no more than ordinary Unit Heaters, yet they have

- totally enclosed motors
- resilient mounting
- wire guards

and are PRESSURE-TESTED to 300 lbs. sq. in.

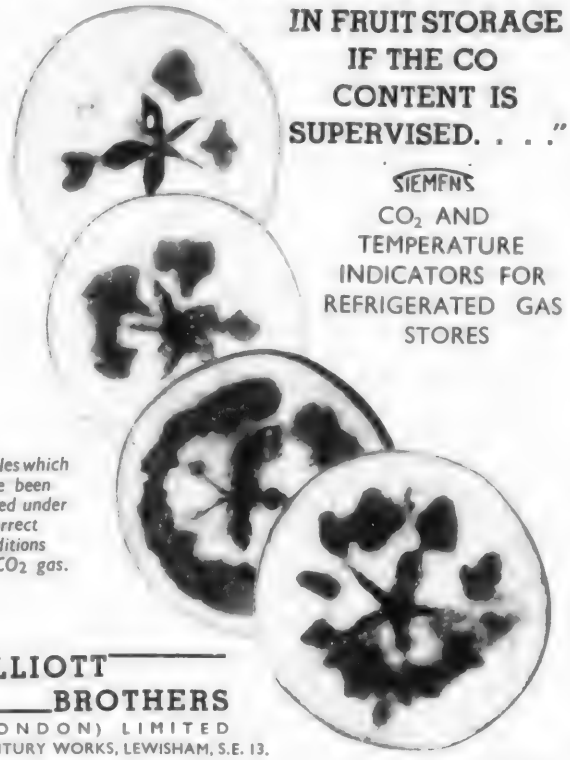
"Calorier" UNIT HEATERS

THE STANDARD AND POCHIN BROS., LTD.

Telephone: 24114 (2 lines). LEICESTER, ENGLAND Telegrams: "Blowing, 'Phone, Leicester"

"THERE'S NO FEAR OF 'BROWN-HEART' IN FRUIT STORAGE IF THE CO CONTENT IS SUPERVISED. . . ."

SIEMENS CO_2 AND TEMPERATURE INDICATORS FOR REFRIGERATED GAS STORES



Apples which have been stored under incorrect conditions of CO_2 gas.

ELLIOTT BROTHERS (LONDON) LIMITED
CENTURY WORKS, LEWISHAM, S.E. 13.

ENQUIRY FORM (F.M.)

(For office use only)

No. _____

Date _____

FIRM _____

ADDRESS _____

TRADE _____ Individual making Enquiry _____

Nature of Enquiry:

_____

_____

_____

_____

_____

N.B.—Subscribers should enclose a stamped, addressed envelope for reply. Non-subscribers will be answered only in the journal, and should enclose a postal order for 1s. 9d. to cover registration fee and a copy of FOOD MANUFACTURE containing the reply. The enquiry may be made either in the space provided above or in a separate letter, but in every case the above form must be completed, and sent to Food Manufacture, 17, Stratford Place, London, W. 1, England.

POWDERED APPLE PECTIN
SPEAS-NUTRL-JEL
NEUTRAL IN COLOUR & FLAVOUR

SOLE DISTRIBUTORS FOR GREAT BRITAIN

SAMPLES, PRICES AND FORMULÆ AND ANY DESIRED INFORMATION FROM

H. MAYER SENIOR LTD.
VANILLA AND GENERAL PRODUCE IMPORTERS
52/3, Crutched Friars, LONDON, E.C. 3

TELEPHONE: ROYAL 2391
TELEGRAMS "VANILLOES, LONDON"

PACIFIC FISHERMAN
The Fisheries Journal of the Pacific
A MONTHLY PUBLICATION SUBSCRIPTION, $4.00 Foreign.
Send for a free sample

Each subscription includes:
The PACIFIC FISHERMAN YEAR-BOOK
containing complete pack figures. Single copies, $1.25 Foreign.

PACIFIC FISHERMAN also publishes:
SALMON PACKERS' REGISTER
a complete directory of packers, brokers, and brands. Per copy, $5.50 Foreign.
WESTERN CANNER AND PACKER
the food packing journal of the Western United States. Subscription, $3.00 Foreign.
71 COLUMBIA ST., SEATTLE, U.S.A.

Direct consignments of
The World's finest
SAUSAGE CASINGS
FRANK A. JAMES
21-23 FARRINGDON ROAD, E.C. 1
Telegrams: "Jammetho, Smith, London." *Telephone:* Holborn 5481 & 7703

SEPARA *Filter Papers*

BRITISH MADE

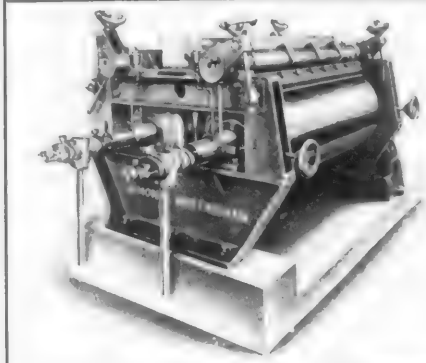
Type Cc., specially suitable for filtering extracts, essences, essential oils, fruit juices, etc.
Type Dc., white crêped, suitable for filtering sugar solutions, coffee, etc.
Type Dh., a tough, hardened paper, particularly suitable for use in coffee machines.

Samples & Prices:
H. REEVE ANGEL & CO. LTD.
LONDON: 9 Bridewell Place, E.C. 4
MANCHESTER: 2 Blue Boar Court
Manufactured by W. & R. BALSTON, LTD., MAIDSTONE, KENT

PICKFORDS
for
ALL
TRANSPORT

FRUIT PULPS
in tins and casks
PICKLING VEGETABLES
fresh and brined
RAW MATERIALS
for
SAUCE, POTTED MEATS
& FISH PASTE TRADES
JOHN F. SEYFRIED & SONS, LTD.
REGIS HOUSE, KING WILLIAM STREET, LONDON, E.C.4
Telephone: MANsion House 6171 (3 lines)

"SPENCER-HOPWOOD"
PATENT WATER-TUBE VERTICAL
BOILERS
SPENCER-HOPWOOD LIMITED
(Associated with Robert Stephenson and Hawthorns Limited)
Works: LOCOMOTIVE WORKS Darlington
London Office: 20, GROSVENOR GARDENS, S.W.1
Phone: SLOane 1396



DRYING MACHINES

ROLLER, TUBULAR, ETC.

SEND US YOUR PROBLEMS

LARGE TEST PLANTS & 50 YEARS' EXPERIENCE AT YOUR SERVICE

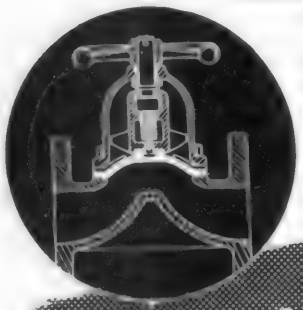
RICHARD SIMON & SONS, LTD.

PHŒNIX WORKS

NOTTINGHAM

YOUR DELIVERIES ASSURED!

Works established in safety zone, with Government assistance, to produce valves for essential industries—and for Export.



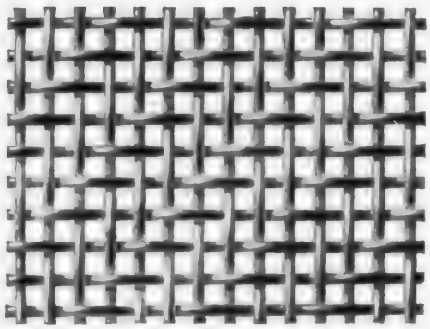
SAUNDERS VALVES

Keep FLUID & WORKING PARTS APART

For interesting data write **SAUNDERS VALVE Co. Ltd. Cwmbran Newport Mon.**

GLOVERS 127

STAINLESS STEEL WIRE GAUZE



IN ALL MESHES

FOR ALL FOOD PURPOSES

Send for our 1939 Catalogue

WM. RIDDELL, COUSLAND & CO. LTD.

SPRINGFIELD WIRE WORKS

GLASGOW, S.E.

Citrus Products Ltd.

MAZOE, Nr. Salisbury, Southern Rhodesia

Established 1931

● **Our Factory, situated on the Estates of the British South Africa Company, is the only one regularly producing concentrated orange juice and also sweet oil of orange on a large scale within the Empire**

● **The Orange Juice** is concentrated seven to eight times, and is completely natural, without any addition of either flavouring material or sugar. Manufacturers can consequently retain complete individuality in building up their finished article. Exhaustive research proves it to contain over 50% more Vitamin C than any other orange concentrate on the market.

● **Our Orange Oil** has been declared by experts to be of finer flavour than that of any other origin.

Stocks are regularly available in London

Telephone: Royal 6200
Telegrams: Rubeck, London

The Sole Selling Agency is with

H. RUBECK, 59, Mark Lane, London, E.C. 3

who will be pleased to submit samples and further particulars.

department of

opportunites

AGENCIES WANTED

ACTIVE Liverpool selling agents covering whole Lancashire, Cheshire Cumberland, North Wales, seek sound lines. Proved extensive connection. Warehousing and Distributing facilities available.—Box 1.604 Lee & Nightingale, Advert. Offices, Liverpool.

AGENCIES for British Manufacturers of Aniline Dyes, Essences for Foodstuffs and Confectionery required by J. Speelmans, Leliegracht 25, Amsterdam.

SELF-RAISING Flour Manufacturers, having large connections in London and Home Counties, are seeking an agency with a reputable firm for an extra line, and who wish to avail themselves of their sales organizations, warehouse and delivery service.—Box B81, *Food Manufacture*, 17, Stratford Place, London, W. 1

PROPERTIES TO LET

OFFICES.—A new modern office building in a quiet cul-de-sac opposite Tube Station, and within easy access to all parts of London, particularly the main railway stations. Central London, Whole floor 5,500 square feet, or could be divided. Excellent lighting. Central heating. Fire staircase. A.R.P. Shelter. Large and spacious passenger lift and a general goods lift serving the floor. The floors: A magnificently appointed and convenient suite of offices with an amount of large open floor area; handsome reception office and waiting room. The accommodation is so arranged as to make it easily and quickly adaptable to almost any purpose.—For full particulars apply to Box B96, *Food Manufacture*, 17, Stratford Place, London, W. 1.

MISCELLANEOUS SALES

A SINGLE MACHINE that crumbs cakes, hard and soft bread, pulps and cuts tinned apples, flakes and nibs almonds, grates cheese and fats, slices rhubarb, mashes potatoes, shreds carrots and turnips.—Particulars from Ultra Rapid Engineering Co., 23, Belgrove Street, Glasgow, E. 1.

HARRY TRUSCOTT (W. W. Brown), 29, Peppard Road, Caversham. Reading, Berks (and at Coupar Angus, Perthshire), for Fruit Pulps. Speciality: Scotch Raspberries, both fresh and preserved

ONE LB. VANOLEUM at 32s. makes 20 lbs. Essence Vanilla by adding hot water, and saves you a £10 note. Trial ounce makes a pint. 2s. 6d., post and package free.—Arthur Whittaker, Newton Heath, Manchester 10.

POWDERED CITRUS PECTIN of highest quality for Jams, Jellies, Confectionery, Sauces and many other ood products. Types and grades for all purposes.—Samples and quotations from P. Samuelson & Co., Importers of Citrus Products, 17 Creechurch Lane, London, E.C.3.

SIEVING MACHINES equipped seven sieves, British Standard Cloths, to customers' requirements. Price £25 5s. Electric motors £2 14s. extra. Also Moisture Testers.—Thomas and Isaac Bradley, Ltd., Heath Road, Darlaston, Staffs.

TIME RECORDERS AND ELECTRIC CLOCKS.—We have a large selection of new and rebuilt models of all systems in stock, fully guaranteed.—Time Recorder Supply and Maintenance Co., 159, Grange Road, London, S.E.1.

VANILLA BEANS.—High prices best met by using Vanilbeena Concentrate. 1 lb. equals 2½ lbs. beans. No extracting, no pressing, and results just as good at half the cost. Also suitable Solvents and Vanilla Essences ready for use.—Dr. Harger Research Laboratories, 172, Bedford Street, Liverpool.

Save Fuel, Time & Money!

By cleaning the tubes of your

WATER TUBE BOILERS—ECONOMISERS
TUBULAR PROCESS PLANT, ETC.,
with

FLEXOTUBE Electric Tube-Cleaning Equipment.

Demonstrations gladly arranged. Write for our New Catalogue

FLEXOTUBE (LIVERPOOL) LTD.
Tube Cleaning Specialists
2 Strand Street
LIVERPOOL, 1

"GOLDEN PHEASANT"
THE QUALITY BRAND
TOMATO PURÉE & PASTE
In the following concentrations:—
12 13% 18 20% 28 30%
FINEST COLOUR FLAVOUR TEXTURE
Made from Sound Clean Specially Selected Tomatoes
WILLIAM GRAHAM & CO.
21 MINCING LANE, LONDON, E.C.3
Phone: MAN. HOUSE 1791/4 Grams: WIREGRACO-FEN

IF *you use* YEAST *let us quote!*

War-time strain and worry bring an enormous *extra* demand for Medicinal Yeast products. If you want to answer public demand, we are one of the Empire's largest suppliers of Yeast—in all forms for Medicinal, Commercial and Food uses. Let us know your requirements, and we shall be pleased to submit Samples and Quotations at once.

THE ENGLISH GRAINS CO. LTD.
BURTON-ON-TRENT

HERBS
for flavouring
Sage—Thyme—Marjoram—Mint—Parsley—Tarragon—Lemon Thyme—Basil—Celery Seeds—Bay Leaves.

DRIED VEGETABLES
Powdered Onion—Garlic—Horseradish—Tomato.

WHOLESALE ONLY

JOSEPH FLACH & SONS, LTD.
64 MARK LANE, LONDON, E.C.3

NOTICE

The prices of

GELOZONE

remain the same, and the manufacturers hope to keep them so.

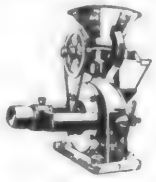
Announcement of:

Whiffen & Sons Ltd.

Carnwath Road, London, S.W. 6

INDUSTRIAL GRINDING EQUIPMENT

UP-TO-DATE GRINDERS AND PULVERIZERS WITH AND WITHOUT FAN AND CYCLONE DELIVERY, IN VARIOUS MODELS AND SIZES.



Speciality:
MILLS FOR ICING AND CASTOR SUGAR.

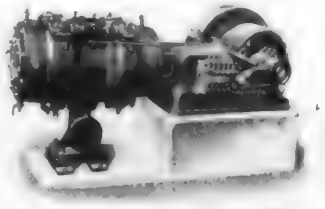
Our unique experience covering over 150 years is at your disposal to solve any grinding problem.

Write for descriptive Lists.

ZACHARIAH PARKES LTD.
47 & 48 HAMPTON STREET, BIRMINGHAM 19
Phone: CEN. 6379. Established 1779.

DRY VACUUM PUMPS
FOR ALL DUTIES

Ask for a copy of our Descriptive Pamphlet No. 256



REAVELL & CO. LTD., IPSWICH

EDIBLE OILS AND FATS

OLIVE—SALAD—FRYING—BAKING OILS. WHITE, GOLDEN & NUT BUTTER SHORTENINGS. CAKE AND PASTRY MARGARINES PUFF PASTRY FAT, VEGETABLE LARDS, Etc.

Wholesale and Retail Trade Supplied.

LONDON OIL CORPORATION LTD.
161, Camberwell Grove, S.E.5. *Brixton 3237-8.*

UP-TO-DATE *Food Producers use* 'Yosa' THE SOYA FLOUR

Sole Manufacturers: CALLOW BROS., LTD., BUTE STREET, LIVERPOOL, 5

SECOND-HAND PLANT FOR SALE

600

VOLKMAN Hanig Vertical Continuous VACUUM SUGAR COOKER; capacity approx. 3 tons per day, comprising vertical vacuum sugar cooker, vacuum pump, sugar pump, copper receiver, copper syrup reservoir, etc., complete with all gauges and connections, and in really excellent condition.

Large Selection of STEAM-JACKETED AUTOCLAVES, all sizes available, with or without agitating gear.

FILM DRIER or LIQUID COOLER, with fully-jacketed drum 7 ft 1½ ins. long by 6 ft. dia. with jacketed film emulsion roller, with scraper knife on main drum, complete with all drive and platforms; belt driven.

Steam-Jacketed COPPER CARAMEL MIXERS, by Brierley, Collier & Hartley, with high-pressure jackets; automatic rise and fall mixing gear. Large selection available, with tilting pans from 27 ins. to 32 ins.

Cast-Iron Steam-Jacketed COPPER PAN; hand tilting, 2 ft. 6 ins. dia. by 2 ft. 3 ins. deep, mounted on C.I. stand, suitable for 80 lbs. pressure. THREE AVAILABLE.

Steam-Jacketed COPPER PANS; comprising stock of high pressure pans of various sizes, both tilting and rigid, all by makers of repute.

Horizontal Steam-Jacketed MIXER; approx. 12 ft long by 3 ft. dia., arranged with stirring gear, driven through fast and loose pulleys through bevel reduction gear.

GEORGE COHEN SONS AND CO. LTD.
STANNINGLEY, Nr. LEEDS

COCHRAN BOILER, 11 ft. by 4½ ft., 1934, 100 lbs. pressure, nearly new condition. Weir Feed Pump. Hindley Vertical Multitubular Boiler, 10½ ft. by 4½ ft., 75 lbs. pressure, both Boilers Oil-fired, complete equipment.—Kimmins & Co., Lyndhurst Road, Worthing.

DOUBLE Crushing Mill, 16 ins. wide, with fast and loose pulleys, complete. No. 3 Perplex Type Grinder. Also 2½ size Christy Disintegrator.—Box A968, *Food Manufacture*, 17, Stratford Place, London, W. 1.

"GRIVEAU" Mixer, wood body with Sifter fitted under, and receiving drawer for sifted materials.—Box A966, *Food Manufacture*, 17, Stratford Place, London, W. 1.

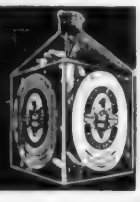
HARRISON CARTER, LTD., Dunstable, have two of their own Disintegrators, taken in exchange for new equipment. All completely overhauled and in every respect equal to new. Sizes, B. Mill and 00.

HIGH-PRESSURE Jacketed Copper Pan. 4 ft. diameter by 3 ft. 6 ins. deep. Bottom half jacketed.—Thomas Mitchell & Sons, Ltd., Bolton.

"HUNT" Dough Mixer and Sifter, two-sack capacity, with tempering Tank and connections.—Box A969, *Food Manufacture*, 17, Stratford Place, London, W. 1.

LEACROFT MACHINERY COMPANY, 1 London Road, Staines, are stock-holders of all types of reconditioned Plant and Machinery. Please send your enquiries, and write for lists.

Keep your containers and food-plant sterile and clean with
TETLEYS ENAMEL
JOSEPH CHATER & SONS, LTD.
785, Commercial Rd., London, E14



PURE FOOD COLOURING
L. LAMBERT & CO. LTD
ESTAB. 1880
COLNE WORKS · UXBRIDGE · MIDDLESEX · PHONE UXBRIDGE · 85

SECOND-HAND PLANT FOR SALE

MACHINERY and Equipment of all kinds, also surplus plant purchased.—Maiden, 211, Royal Liver Building, Liverpool. Telephone: Central 1521.

MELANGEUR, Makers Paul Franke—dia. of Pan, 5 ft. 7 ins.; Iron Runners, 23 ins. dia. by 16 ins. wide; Steam coil heated. Box A964. *Food Manufacture*, 17, Stratford Place, London, W. 1.

MELANGEUR, Pan, 4 ft. 6 ins. inside dia.; Granite Runners, 25 by 14 ins., and fitted with rising gear. Also Lehmann Melangeur, 4 ft. 4 ins. dia.; Granite bed; Runners, 23 by 8½ ins.; Steam heated.—Box A965, *Food Manufacture*, 17, Stratford Place, London, W. 1.

MIXING MACHINE.—Baker Perkins Universal Kneading and Mixing Machine, half-ton size, as new. Complete with tilting gear.—Barron, Engineers, Gloucester.

MORTON Whisk, 5 gallon capacity, with variable belt-drive. Also Thomson Two-Sack Dough Mixer, automatic tilting and reverse action.—Box A970, *Food Manufacture*, 17, Stratford Place, London, W. 1.

RECONDITIONED 3-speed Cake Machines by Reads. Also several Ovens. Low price for cash or terms.—Reads & Barrons Mixers, Ltd., 260, Kilburn Lane, London, W. 10.

REFRIGERATION PLANT (second-hand), CO_2, Sarbo make, 15 h.p., includes Compressor, Evaporator, Condenser Coils, 10 by 8 ft. water and brine cooler, pumps, piping, shafting, etc. Cheap.—Apply, Bamber, Broxton, Chester.

SELF-GENERATING, Gas (100 S.P.)—Caramel Toffee Mixer; Hounsell Equalising Toffee Plant; B.C.H. Caramel Press; Morrison Long Arm Box Wire Stitcher; Kek Centrifugal Grinding Machine; Screw Syrup Press; Juice Filter Press; Burrough's Adding Machine; Baker Five-Steel Roller Refiners; 1,000 Chocolate Kettles and 1-cwt. Cream Beater; Reiche Dropping Machine. Anything else enquire.—E. W. Wallbridge (The Reliable Englishman), 136, Sefton Street, Southport. Appointments ('Phone 5428).

SILVERED-COPPER CONCENTRATING EVAPORATOR for treating 110 gallons liquid per hour, complete with extraction pump, condensing equipment, accessories.—Vacuum Refrigeration Ltd., 39-45, Finsbury Square, London, E.C. 2. 'Phone: NATional 0081.

SIMON Vertical Grinding Machine with 12 ins. Emery Compo Stones, also similar with 30 ins. Stones.—Box A967, *Food Manufacture*, 17, Stratford Place, London, W. 1.

SORENSEN BAKERY EQUIPMENT, LTD., 254, Stretford Road, Manchester, 15, will gladly quote you for all types of new and reconditioned machines, ovens, etc.

BUSINESS OPPORTUNITIES

CAPITAL.—Bank Official (retired), having procured £2,000 to £40,000 for many Companies, proofs available, has Clients with £2,000 to £5,000 each wanting Directorships.—Write Box 142 at Horncastle's, 103, Cheapside, E.C.2.

SUB-CONTRACT for work of national importance required by manufacturers of nationally distributed products. Recently extended modern premises in north-western reception area, with adequate accommodation for further expansion. Excellent rail and transport facilities. Sufficient organisation with laboratory, qualified technical staff and ample labour. All correspondence will be confidential, and in the first instance contractors are asked to indicate the type of product required to Messrs F. J. Thairlwall and Co., Solicitors, Verulam Building, Gray's Inn, W.C. 1, marking envelope "Contract."

TUFNOL

Regd. Trade Mark.

THE MATERIAL OF UNLIMITED USES

ELLISON INSULATIONS LTD., PERRY BARR, BIRMINGHAM 22

118

The "ALITE"

COMPRESSION FILLER

For Pastes, Powders, Mincemeat, etc.

Fills exact quantities into tins, cartons, bags, etc. Any degree of compression of a powder may be obtained.

The "ALITE"

MIXER

High Output at Low Cost.

It's in your own interests to investigate the Alite efficiency methods . . . by means of a demonstration with your own product!

THE ALITE PATENT MACHINE CO. LTD.

12 HOLLOWAY ROAD, LONDON, N.7

Telephone: North 2334

"SCOT" HIGH-SPEED

Cutting, Mixing, Mincing and Filling Machines

For **MEAT** and **PASTE, JAM** and **PRESERVE MANUFACTURERS**

No 50 "SCOT" SAFETY CUTTING & MIXING MACHINE

STAINLESS STEEL SHAFTS AND KNIVES

CATALOGUE ON REQUEST

Sole Manufacturers:

MACNAUGHTON & WATSON LTD.

ENGINEERS - - - GLASGOW, S.E.

SECOND-HAND PLANT WANTED

WANTED, a Second-hand Zeiss or Abbe Refractometer.—Send particulars to Box A598, *Food Manufacture Weekly*, 17, Stratford Place, London, W.1.

WANTED, MACARONI Extruders and Drying Ovens, new or second-hand.—Wembley Packing Co., Ltd., Exhibition Grounds, Wembley.

WANTED, Marconi Press, new or second-hand.—Furnish full particulars to Box A599, *Food Manufacture Weekly*, 17, Stratford Place, London, W.1.

WANTED, Rotary Dryer for drying Bread and Biscuit Rusk. State price, make, size, condition, output and all particulars to Box B76, *Food Manufacture*, 17, Stratford Place, London, W. 1.

WANTED, Retort. Give full details and price.—Box B91, *Food Manufacture*, 17, Stratford Place, London, W. 1.

WANTED, Second-hand Alfa-Laval or Sharples Separators.—Write, giving full particulars, to Box A604, *Food Manufacture*, 17, Stratford Place, London, W. 1.

WANTED, 200 to 300 lbs. capacity Gardner Sifter and Mixer.—Box A971, *Food Manufacture*, 17, Stratford Place, London, W. 1.

CONSULTANTS

FOOD CONSULTANT.—Experienced in food manufacture and laboratory control. Salad cream, mayonnaise and allied products, pickles and sauces, jam and marmalade, pectin extraction, fruit drinks, processed cheese and fruit canning.—Apply Box B73, *Food Manufacture*, 17, Stratford Place, London, W. 1.

SITUATIONS WANTED

BAKER'S SUNDRIES.—Production Manager desires change. Expert knowledge, practical, technical. No objection to small Company, if progressive, at home or abroad.—Box B97, *Food Manufacture*, 17, Stratford Place, London, W. 1.

CANNED Food Expert. Soups, Fish, Fruits, etc., Preparation, processing, factory and laboratory control.—Box B93, *Food Manufacture*, 17, Stratford Place, London, W. 1.

FACTORY and Production Manager, with sound organising ability. Has a complete knowledge of many food processes with research and bacteriological experience. Strict disciplinarian. Seeks engagement owing to hostilities. Last appointment 16 years' prominent concern.—F. W. Bryant, 11, Cavendish Close, Bournemouth.

MEAT PRESERVATION; Ham canning; Cooked meats; Smalls; Offals; Slaughtery; Bacon curing; By-products; Casings; all kindred manufactures; Staff engagement and training (both sexes); Plant layout; Routine planning; Mechanical flair; Accurate, profitable production control; Theory-into-practice; Ideas; Results; Wide and substantial experience offered for executive position of scope and progressive development.—Box B95, *Food Manufacture*, 17, Stratford Place, London, W. 1.

WORKING FOREMAN, practical experience in jams, peels and glacé cherries, mincemeat.—Apply Apps, 7, South Avenue, Chingford, Essex.

EVERY PROCESS **BRITANNIA** AMHERST 3261/4

CARDBOARD BOXES

SPECIALISTS IN MODERN CARTONS AND DISPLAY BOXES

•

BRITANNIA FOLDING BOX CO. LTD.

DACE ROAD, OLD FORD, LONDON, E. 3

PATENTS AND TRADE MARKS

KINGS PATENT AGENCY LTD. (B. T. King, A.I.Mech.E., Patent Agent), 146a, Queen Victoria Street, London, E.C. 4. Phone: City 6161. Advice, Handbook, and Consultation free.

PATENTS AND TRADE MARKS.—Any readers requiring information and advice respecting Patents, Trade Marks, or Designs, should apply to Rayner & Co., Patent Agents, of Bank Chambers, 29, Southampton Buildings, Chancery Lane, W.C. 2, who will give free advice to readers mentioning "Food Manufacture."

PATENTS for Inventions: A concise Guide for Inventors and Patentees, by Reginald Haddan, F.C.I.P.A. 100 pages, 15 separate chapters, 3s. 6d.—Order from Industrial Book Department, *Food Manufacture*, 17, Stratford Place, London, W. 1.

THE owners of British Patent No. 437,683, relating to "Improvement in Pectin and its Manufacture," are desirous of entering into negotiations with one or more firms in Great Britain for the purpose of exploiting the invention either by sale of the Patent Rights or by the grant of Licences on reasonable terms.—Interested parties who desire further particulars should apply to Albert L. Mond & Thiemann, 14 to 18, Holborn, London, E.C. 1.

TRADE MARKS and their Protection under the Trade Marks Act, 1938, with notes on protection abroad by Reginald Haddan, F.C.I.P.A. 128 pages, 7 concise chapters, nature ownership, registration appeals, assignments, etc., remedies, provisions, protection. Index 5s.—Order from *Food Manufacture*, 17, Stratford Place, London, W. 1.

INVESTIGATE THE USES OF

SOYOLK

The Pioneer Edible SOYA FLOUR

Manufactured by

SOYA FOODS, LTD., RICKMANSWORTH

DUKERON ENAMEL

First in the Field

See our larger Announcement for further details

The original and still the best lining for all containers and plant used in the FOOD & BEVERAGE INDUSTRIES

MURPHY & SON LTD., Wheathampstead, Hertfordshire

Telephone: WHEathampstead 2161

Telegrams: Indewrad, Wheathampstead

CHOCOLATE COUVERTURES

"MAVIS" CAKE COVERING CHOCOLATE

CHOCOLATE VERMICELLI & GRANULES

A SPECIALITY

THE BRITISH COUVERTURE CO., LTD.

4, Rangoon Street, E.C. 3

ESSENCES · ESSENTIAL OILS

FLAVOURINGS

FRUIT SYRUPS · GELATINES

OLIVE OIL

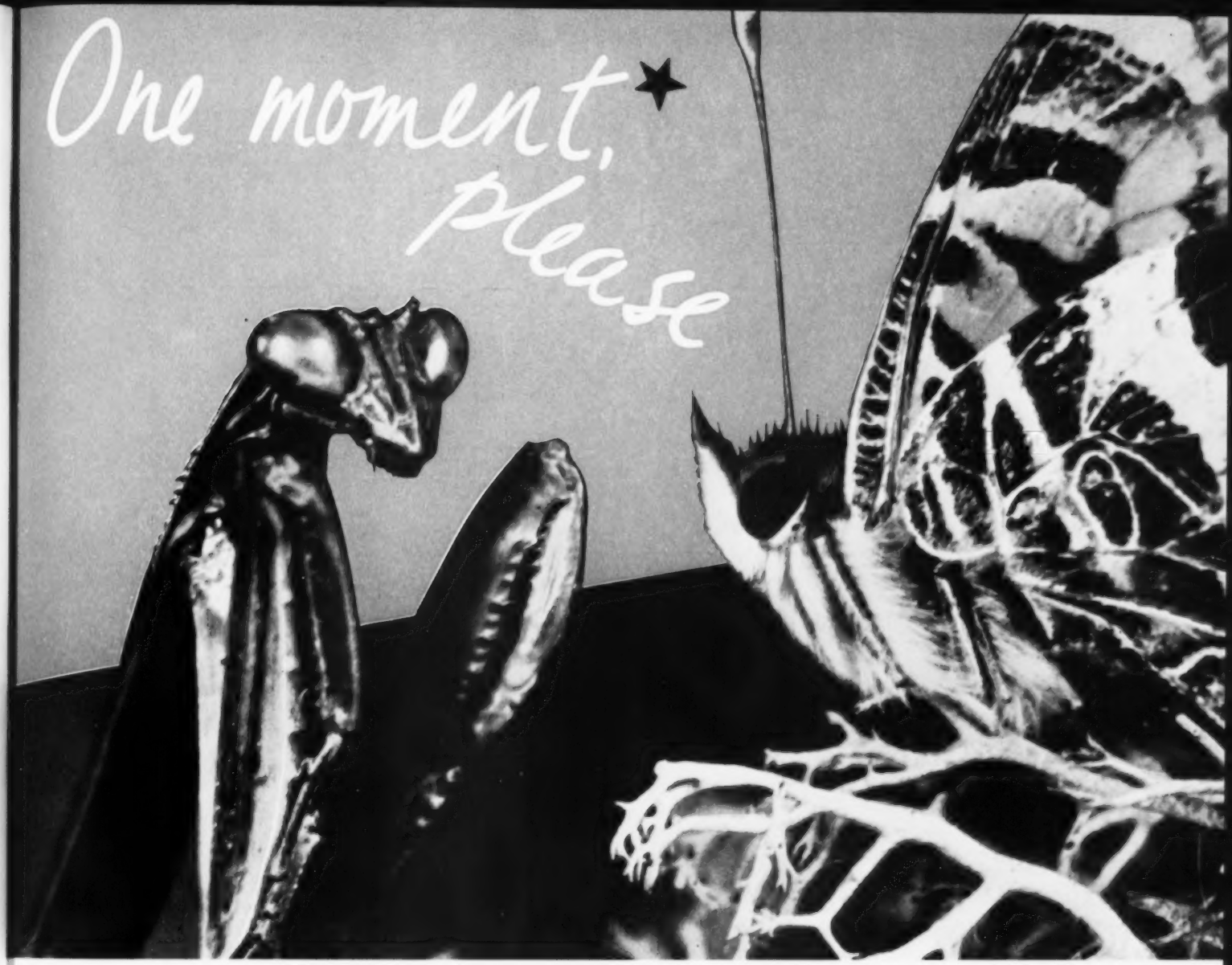
C. W. FIELD LTD.

92, WOOD STREET, LIVERPOOL, 1

Telephone: Royal 4110 (3 lines)

5, Great James Street
Bedford Row, London, W.C. 1
Telephone: Holborn 8251

1, Crow Street
Dublin
Telephone: 21162



We want to tell our many friends in the Food Industry that **the price of Spirax Steam Traps and Strainers has not been increased.**

The knowledge that correct steam trapping really does result in fuel economy has led to such an increased production of Spirax products that we have so far been able to swallow higher labour and material costs, war risk insurances and so on. Unfortunately we can't hold this position very much longer, so if you possibly can foresee your requirements it might be as well to purchase soon.

Having built a new Works to cope with this demand we can give good deliveries.

SPIRAX MANUFACTURING CO. LTD.

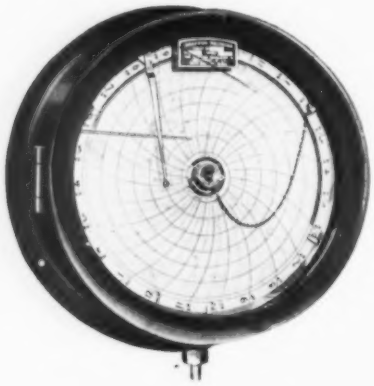
CHELTENHAM, GLOS.

Telephone : Cheltenham 5175. Telegrams : Spirax, Cheltenham

LONDON OFFICE : 28 VICTORIA STREET, S.W. 1 Telephone : Abbey 6101

SPIRAX TRAPS ARE AN ENTIRELY BRITISH PRODU

Ceaseless Watch.....



As a preliminary we suggest a check on some of your heavier heat consuming plant by means of a Drayton recorder. The data obtained frequently brings opportunities for economy and improvement into focus that would not otherwise be apparent.

The enemy in industry is waste—waste of materials, waste of time, waste of manpower, waste of production cost, and waste of opportunity.

The most deadly form of waste is the small, continuous loss that is not obvious until a running check is made over weeks or months, such as can easily and inexpensively be made in the case of heat processing by using automatic temperature or pressure regulators or recorders.

The Drayton range of such equipment is singularly comprehensive. From it may be selected suitable instruments to meet individual requirements. Our catalogue of heat economy instruments will be sent to you on request.

A 113

THE DRAYTON REGULATOR & INSTRUMENT CO. LTD.
WEST DRAYTON MIDDLESEX

Printed for the Proprietors, LEONARD HILL LIMITED, and published by them at their Offices, 17 Stratford Place, London, W. 1,
by Billing and Sons Ltd., The London Printing Works, Guildford and Esher, England.

Registered at the General Post Office as a Newspaper.